Development of Indicators for Monitoring Progress Towards Health for All by the Year 2000

WORLD HEALTH ORGANIZATION

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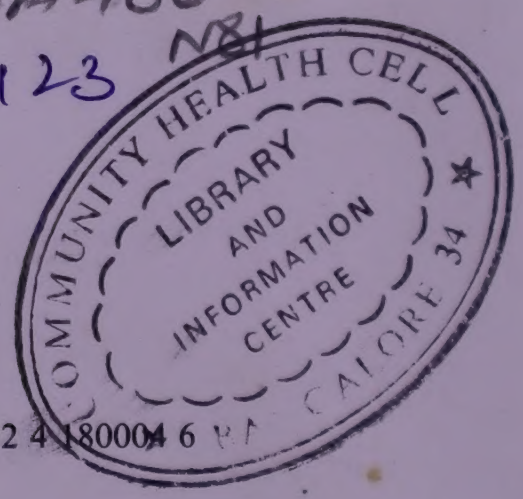

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2. INFORMATION REQUIREMENTS

Preface

This volume is intended to help Member States of the World Health Organization decide which indicators to use, particularly at the national level but also at the regional and global levels, for monitoring progress towards health for all by the year 2000.[1]

It proposes *four categories of indicators:* health policy indicators; social and economic indicators; indicators of the provision of health care; and indicators of health status, including quality of life. In the past, there has been a tendency to concentrate almost entirely on health status indicators. The meaning of "health for all" as explained in the Global Strategy for attaining it (*1*),[2] namely, a level of health that permits all people to live a socially and economically productive life, shows why other categories of indicators are also necessary.

Particular emphasis has been given to the *information requirements* for the various indicators, the principal sources of data and alternative methods of data collection, and the information analysis involved.

In addition to the *relevance* of certain indicators for policy decisions and for monitoring progress, the most important criterion for selecting them is the *feasibility* of gathering the information required. This implies not only technical feasibility but also the financial and managerial feasibility of collecting the necessary information. Such feasibility cannot be taken for granted in most countries.

The question of *selectivity* is equally crucial, particularly for developing countries, where the health services are rarely adequate to permit the routine information collection with a minimum of accuracy, and will not be adequate until primary health care is more firmly established. It is still very difficult to get the information where it matters most—at the community level.

Indicators have to be seen as a tool to be used in a well defined national process for *monitoring and evaluating* strategies for health for all. Such a process has to be introduced, not only at national level, but at regional and global levels as well in order to permit further guidance for the strategies at these levels.

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[1] It was prepared in response to a request by the Executive Board of WHO and following consultations with Member States, the regional committees and selected members of the expert advisory panels of WHO. It was circulated to the Board, at its sixty-seventh session in January 1981, as document EB67/13 Add. 1. It has since been revised in the light of the discussions in the Executive Board and at the Thirty-Fourth World Health Assembly (May 1981).

[2] See list of references on pp. 81-82.

A short list of twelve indicators for monitoring the progress of the Global Strategy for health for all is also included. Information on these twelve indicators cannot just be an aggregation of national indicators. Variations within countries and among countries are too great to make this useful. It is for this reason that the indicators for use at the global level are presented as "the number of countries" that have attained certain values for the indicators concerned—for example: *x* countries with an infant mortality rate below 50 per 1000 live-births (paragraphs 121-124).

It should be noted that the use of these global indicators implies that countries will commit themselves to use at least these and to report on them. It also implies that the WHO regional committees, the Executive Board and the World Health Assembly will have to commit themselves to use them and will have to take a firm stand to make sure that the information is forthcoming.

1. Indicators and Their Use

Introduction

1. This volume has been prepared to help the Member States of WHO decide on the indicators to be used at national and international levels as part of a process of monitoring and evaluating progress towards the attainment of health for all by the year 2000. The volume concerns itself with the use of indicators, their information requirements and consequent selection of a manageable number of indicators based on defined criteria. It suggests indicators related to the health policy; to the main social and economic factors which constrain and influence the health sector; to the provision of health care; and to the health status of the population. Part 2, on information requirements (paragraph 125 *et seq.*), is intended to help countries to select indicators based on their assessment of the organizational, technical and financial feasibility of collecting and analysing the information required.

2. The Member States of the World Health Organization have pledged to work together to attain the goal of a level of health for all the people of the world by the year 2000 that will permit them to lead a socially and economically productive life. This goal is a further interpretation of WHO's constitutional objective set out in 1948, namely: "the attainment by all peoples of the highest possible level of health". The International Conference on Primary Health Care, held in Alma-Ata, USSR, in 1978, declared that primary health care is the key to achieving an acceptable level of health throughout the world in a foreseeable future. The report of that Conference describes what primary health care and the supporting health system are all about, and the document of WHO's Executive Board, *Formulating strategies for health for all by the year 2000 (2)*, outlines how strategies for health for all might be prepared in the light of the Declaration of Alma-Ata and the recommendations made there (*3*).

3. Member States are now engaged individually in developing or updating strategies to attain health for all in their own countries. They are also engaged collectively in developing or updating regional and global strategies in support of these national strategies. They will wish to know what progress they are making towards reaching the goal. Each country will no doubt define various intermediate and final targets that will enable them to reach the goal, e.g., ensuring enough of the right kind of food for all by 1985; an adequate supply of safe drinking-water and basic sanitation for all by 1990; the provision of immunization against the major infectious diseases for all children by 1990; the provision of essential drugs for all by 1986. Governments can then devise the most appropriate ways of reaching these targets. But they cannot simply assume that, by defining targets and devising ways of reaching them, they will, in fact, reach them. Nor, in a world where knowledge and circumstances are constantly changing, can

they assume that the targets and specific objectives initially set will prove to be the most appropriate and economic ones for attaining the overall objective—a level of health which will permit their people to lead socially and economically productive lives. How, then, can they know what progress they are making towards reaching the targets and the ultimate goal ? To find out, they will have to introduce a systematic *monitoring and evaluation process* as part of their strategies. In applying this process they will face the question of *indicators of progress.*

4. In its document on the formulation of strategies for health for all by the year 2000 (*2*) WHO's Executive Board stressed the need for indicators to monitor and evaluate progress towards the goal of health for all. The following are the relevant paragraphs :

"61. To permit governments to know whether they are making progress toward attaining an acceptable level of health for all their people, it is important that they introduce at the earliest stages a process of evaluation. This will include the assessment of the effectiveness and impact of the measures they are taking, and the monitoring of the progress and efficiency with which these measures are being carried out.

"62. Monitoring of implementation and evaluation of impact take place at two levels—the policy level and the managerial and technical levels—but the two have to be interlinked. At the policy level there is a need to know if the health status of the population is improving and if revisions of the policy, strategy and plans of action are required. At the managerial and technical levels there is a need to know if relevant programmes are being properly formulated and if corresponding services and activities for implementing them are being adequately designed. There is also a need to know if programmes are being efficiently implemented through suitably operated health and related social and economic services.

"63. There is thus a need for two types of indicators—those that measure the health status and related quality of life, and those that measure the provision of health care. In both cases, high selectivity has to be employed so that the use of indicators becomes manageable and meaningful. Two basic health indicators concerned with survival that are suggested for measuring the attainment of the ultimate goal of an acceptable level of health for all are life expectancy at birth and infant mortality rate. Each country will decide on its own norms, but a minimum life expectancy of 60 years or more at birth, and a maximum infant mortality rate of 50 per 1000 live births, are suggested as indicating that the health status of the population is becoming a decreasing burden on individual, family and community development. It should be recalled that indicators are not synonymous with targets, but are measures of the extent to which those targets are being reached. All countries, even if the health indicators show that the above norms have been attained, will wish to develop strategies for improving still further the health status of their people, and will consequently wish to define targets to this end. It should also be noted that indicators of survival become less relevant as countries develop socially and economically.

"64. Other indicators measure not only survival but also the quality of life. This implies that social as well as health indicators have to be used. Examples of these are indicators of growth and development, indicators of nutritional status, and specific morbidity rates, particularly in children. Other indicators relate to social conditions and factors that affect health status directly or indirectly, or the use of health services—for example, indicators of educational and cultural levels, of the status of women, of housing and of environmental conditions. Yet other indicators relate to psychosocial factors and mental health aspects of the quality of life. A number of relevant social indicators remain to be developed, such as those for assessing the degree of community self-determination, social and economic productivity, and the closure of gaps in the distribution of health resources. To arrive at these, there is a need to make use of intersectoral research.

"65. In monitoring implementation through the provision of health care, it is important to use as reference points those objectives and targets that have been set as part of the process of formulating programmes and designing the health system. It is particularly important to monitor whether priorities are being adhered to, realizing that these may have to be implemented progressively. Indicators are then selected that can measure change toward attaining the objectives and reaching the corresponding intermediate and final targets, for example : the percentage of the population having safe drinking-water and waste disposal systems ; the rates for women attended by suitably trained health workers during pregnancy and childbirth ; and the percentage of children immunized against the common infectious diseases. It will be necessary to develop locally suitable indicators of coverage and accessibility of services as a measure of the provision of health care.

"66. Whatever the indicators selected, they have to be closely related to the means available for data collection and processing, including lay reporting, and should be gathered as an intrinsic part of the system for delivering health care. Sampling often suffices, and has the advantage of avoiding overloading health workers with routine data collection, which often leads to inaccurate reporting and unused information. Such sampling should take into account all strata of the population and other factors as appropriate to the country concerned, in order to reveal country-wide variations in addition to the national average."

Why indicators ?

5. If "health for all" was one single, easily quantifiable entity for all people, the question of selecting relevant indicators would scarcely arise. But since by its very nature it means many different things to different people, it is necessary to identify those indicators that could illustrate to the people concerned if they are making progress towards reaching a level of health that is "the highest possible" in their circumstances. Such indicators are discussed in these pages, with the aim of facilitating decisions by governments on the indicators they may want to use to monitor progress in attaining their health goal. The potential usefulness and limitations of indicators, the information collection and analysis entailed, the problems

that are likely to be encountered, and the conflict between the need for indicators in order to gain insight into the situation and the difficulty in obtaining the information required, are outlined.

What are indicators ?

6. As the name suggests, indicators are an indication of a given situation, or a reflection of that situation. In WHO's guidelines for health programme evaluation[1] they are defined as " variables which help to measure changes ". Often they are used particularly when these changes cannot be measured directly. They have been given scientific respectability : for example, the ideal indicators should be *valid*—that is, they should actually measure what they are supposed to measure ; they should be *objective*—the answer should be the same if measured by different people in similar circumstances ; they should be *sensitive*—that is, they should be sensitive to the changes in the situation ; and they should be *specific*—that is, they should reflect changes only in the situation concerned. In real life there are very few indicators that comply with all these criteria. Their scientific respectability therefore has to be tempered with a certain humility. As stated above, indicators are merely reflections of a " real thing ". They are indirect or partial measures of a complex situation, but if measured sequentially over time they can indicate direction and speed of change and serve to compare different areas or groups of people at the same moment in time.

7. The main emphasis, in this volume, is on indicators for *use at the national level.* Countries may use national averages sequentially over time to assess progress in attaining the objective of their own strategies for health. The focus on the national level, however, does not mean that only country averages are important. On the contrary, indicators are needed *to illustrate the differences in health situations within countries* if they are to be meaningful in showing progress and for identifying operational stategies.

8. Indicators can also provide yardsticks whereby countries can compare their own progress with that of other countries, especially countries at similar levels of socioeconomic development. International comparisons can be helpful in determining to what exent a region as a whole or a group of countries is making progress towards health for all. Similarly a global perception of the health situation can be gained. The goal of " health for all " draws attention to the " all ". At present, health resources are not shared equally by all the people ; significant gaps still exist in many countries, and health is the privilege of the few. Indicators should reflect progress towards correcting this imbalance and closing the gap between those who " have health " and those who do not. This is a fundamental principle for the selection and use of indicators relating to primary health care.

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[1] *Health programme evaluation. Guiding principles for its application in the managerial process for national health development.* Geneva, World Health Organization (" Health for All " Series, No. 6) (In press).

The uses of indicators and criteria for their selection

9. Hundreds of possible health and health-related indicators exist. WHO's task is to provide a suggested selective list from which countries can choose those which are most relevant to their health and socioeconomic situation and which it is feasible to collect and analyse. The selection of indicators should be guided by the uses to which they are put. In this volume the *selection of priority indicators to monitor progress towards health for all has been based upon the primary health care concept* as outlined in the report of the Alma-Ata Conference (*3*).

10. As mentioned above, the indicators presented in these pages aim at monitoring progress. They should not be confused with objectives and targets. As defined by WHO in its Sixth General Programme of Work (*4*, p. 109), objectives are desired aims and targets are objectives that have been made more specific in quantified terms or in terms of time. Indicators are used as markers of progress towards reaching objectives and targets. They are not numerical targets in themselves. Those mentioned here are for use as *markers of progress* being made towards reaching the objectives and targets set by countries to attain health for all their people. Each country will define health for all in terms of general objectives such as improvement in health status of all its citizens, coverage of the population with essential primary care, improvement in health-related socioeconomic conditions, etc. Countries may also define targets with respect to such objectives. Indicators can illustrate how far these objectives and targets are being achieved. Another use of indicators is to motivate people to action. They can help in the identification of priorities, in stimulating action where necessary and in challenging assumptions about strategies and targets, forcing policy-makers and managers to rethink appropriate strategies.

11. Perhaps one of the more important uses of health indicators is to monitor the progress of overall socioeconomic development of a country. The level of health and nutrition itself is a direct indicator of the quality of life, and an indirect indicator of overall socioeconomic development. Increasingly, development planners and economists are looking for social indicators such as health status measurements to guide decisions on economic development strategies. This is an additional reason why it is particularly important *to select a small number of national indicators that have social and political punch in the sense that people and policy-makers will be incited to action by them.*

12. For example, if in a country the mortality rate for children of 1–4 years is shown to be as high as 50 times that of the more affluent countries, or 20 times that of a country at an equivalent socioeconomic level, policy-makers may be ready to take some action. Also, if it becomes apparent in a country that some sections of the community have an infant mortality rate of over 150 per 1000 while other sections of the community show rates lower than 50 per 1000, people and decision-makers may be stimulated to respond in order to close this gap. The above shows how indicators can be used to foster a more equitable distribution of health

resources among and within countries. This illustrates the use of indicators to influence policy; a restricted list of such indicators is needed. It is emphasized once more that the distribution between the highest and lowest figure within the country is more important than national averages.

13. Another important use of indicators is for the *monitoring of health programmes at different levels.* This may be at the level of the national health ministry, of subnational administrative units as provinces or districts, or at the local peripheral health system and community levels. At the *local level* it may be found useful to identify and use indicators, including innovative ones, that are particularly relevant to the community concerned for monitoring changes in health and related socioeconomic status. National indicators, used either for overall policy decision or for technical and managerial decisions within the health sector, will nevertheless have to be derived from information gathered at local level. This could be collected either from ongoing programmes or through special studies or surveys. In other words, the same information may be collected both for national policy-makers and for technical and managerial use, but it may be analysed, interpreted and presented in a different way, depending on the level of aggregation or disaggregation required. For example, district medical officers of health will need to monitor the incidence of a particular disease for which some preventive programme is being implemented—such as measles, as part of a measles immunization programme. They will need to know what proportion of the children in their district has been immunized, in which areas epidemics are still occurring and the disease-specific mortality rate—at least for children seen by health services. At the national technical and managerial level the indicators needed are similar, but relate to the whole country. For the national policy-makers, however, it may be sufficient to illustrate the very high child mortality rate to which this preventable disease, measles, is a main contributor.

Information requirements (Overview)

14. However potentially useful an indicator may be, the organizational, technical and financial feasibility of collecting and analysing the information required for it is the decisive factor as to whether or not to use it. A brief analysis of information requirements is therefore presented in the following paragraphs. Detailed notes on information requirements for indicators are presented in Part 2 (paragraph 125 *et seq.).*

15. There is the trade-off between what is relatively simple and cheap to collect and the degree of precision of the information or its validity. It has to be remembered that the countries that most need information for selecting priorities for the allocation of limited resources are usually those that are least able to obtain the information precisely because of the limitation of resources and inadequate data collection mechanisms. A balance has to be struck between the allocation of resources to information collection for making priority decisions about alternative strategies and action and the allocation of resources to the programmes themselves. It is important that the collection of information should not be undertaken as an

alternative to decision-making. Moreover, many important indicators cannot be easily quantified—for example, political commitment to attaining health for all. The quest for quantification, whether for planning or evaluation, should not impede action.

16. But *what degree of precision is really necessary?* This varies with the indicator. For example, for policy-making and health programming the order of magnitude of the infant mortality rate is much more important than its exact value. It is much more important to know whether the rate falls within a certain range (e.g., 120 and over, between 20 and 60, or less than 20 per 1000 live-births) than to know its exact value (e.g., 168 or 21).

17. In terms of cost-effectiveness there are decreasing returns for investment of resources in information collection to obtain greater accuracy.

18. The following sources may be used to obtain the data :

(a) vital events registers ;

(b) population and housing censuses ;

(c) routine health service records ;

(d) epidemiological surveillance data ;

(e) sample surveys ;

(f) disease registers ; and

(g) other sources of data (including data from sectors other than health).

19. The following summary is given on these data sources, which are discussed at length in Part 2 (paragraph 125 *et seq.*).

20. The sources mentioned above are potentially available in most countries, but are sometimes insufficiently utilized, or their potential is not recognized.

21. One of the principal data sources is *the vital events register,* which includes data on live-births, deaths, fetal deaths, marriages, adoptions, etc., and should ideally provide comprehensive coverage of a total country, particularly for the calculation of demographic indicators. However, in reality these registers do not yet function satisfactorily in many countries, which makes it necessary to look for other sources.

22. *Population and housing census data* are important sources of economic, social and demographic information. Data on the total population, its age structure and geographical distribution are essential for almost all health indicators, and if no census has ever been carried out it may not be possible to obtain quantified health indicators. A country will have difficulties in planning and evaluating in the absence of any demographic information, and some form of enumeration or census, however rudimentary, is therefore useful for obtaining more specific information about health. However, such censuses, which are not carried

out by the health sector, are usually taken only once every 10 years ; their usefulness for monitoring purposes is therefore limited, unless adjustments are made regularly utilizing other data sources for updating the information.

23. In the field of health *routine health service data* are an essential source of information on disease-specific morbidity and mortality, on certain measurements of children, and on the various activities carried out by the health services. This information, obtained from ongoing programmes, is relatively cheap and easy to collect and analyse. It is, however, incomplete and often inaccurate, especially when those responsible for collecting it at the periphery are not taught how to use it themselves ; are overburdened with so much form-filling that this activity seriously interferes with their service functions ; have no feedback or see no relevance in collecting the information ; or are generally unsupervised. There is another drawback when the data collected are not oriented towards particular problems to be solved or tasks to be fulfilled. The record systems of health services are often kept for administrative purposes rather than for monitoring, which means that data on required denominators are not available—for example, the population at risk or the population to be covered by a particular service. All this, however, can be corrected if there is sufficient commitment to obtaining relevant selected information ; before looking for information sources other than health service information, ways of improving this information source should be found — and this can often be done with relatively limited resources.

24. *Epidemiological surveillance* is yet another activity which leads to useful information, particularly data on endemic disease patterns or on efforts made to control these diseases, such as immunizations performed on certain population groups or insecticide-spraying programmes. Such surveillance has to be carried out on a nationwide scale or at least in several representative regions of a country if it is to provide useful information.

25. Perhaps the source of information most frequently resorted to is the *sample survey* or *community survey.* The usefulness of such surveys rests on their ability to provide data when other sources are absent. These surveys can also be used to complement health service information with relevant and timely data. They do not need to be expensive or elaborate. Usually a household is the most common unit from which samples are drawn. Household surveys can be undertaken by members of the community, including school-leavers or schoolchildren during vacations ; village agents or local officials can record vital events, and even some information on age-specific and disease-specific mortality can be crudely but effectively obtained by using simple " lay-reporting " methods (*5*) ;[1] postal questionnaires

[1] The term " lay reporting " has recently been questioned in certain countries ; the search for a more suitable term continues.

can be sent to schoolteachers, for example to assess the prevalence of lameness resulting from poliomyelitis. These are given as illustrations of what might be done using selective sampling techniques. What is required is initiative, enthusiasm and some organizational skills.

26. *Disease registers* are a further source of information. They are often set up to provide data on mortality and morbidity from selected specific diseases, treatment given, and other information. Such disease registers require the close cooperation of all sectors of the health services in order not to suffer from omissions due to underreporting; by their very nature they tend to include many more data from hospitals than from community health facilities.

27. Yet *other data sources* need to be used. For example, designated members of the community can be useful in collecting information on births and deaths, and schoolteachers, on specific diseases in children and on their nutritional status. Nonprofessional community health workers can provide valuable information using simplified disease nomenclature and the local vernacular.

28. Under this category of "other sources" fall also the sources in sectors other than health, such as central statistical services, or international surveys such as those of the United Nations or the World Bank. However, the national data collected are often so heavily processed to secure comparability for international use that their interpretation in local terms is not easy. This underscores the importance of strengthening national statistical services in order to improve the quality of information sources.

29. In summary, consideration of information requirements and of the practical problems involved in determining and using indicators leads to the conclusion that *selectivity must be the keynote. More will be gained by selecting a small number of relevant indicators for which a country can obtain the information within its resources than by aiming at comprehensiveness.* Also, it is better to accept some imperfections in the accuracy of the information than expend undue efforts on precision.

Categories of indicators for use by countries

30. The following list of indicators is neither comprehensive nor mandatory. It is a selected group put forward to help countries select the indicators they will use for the assessment of progress towards health for all. The suggested indicators are grouped under four broad categories; health policy indicators; social and economic indicators related to health; indicators of the provision of health care; and health status indicators. There are more difficulties in gathering relevant information for some of these indicators than for others. Some countries may wish to go well beyond such a list; indeed, for the more technical and managerial functions other indicators may have to be selected or developed. The following is intended merely as a starting-point for health progress evaluation.

(1) Health policy indicators :
- — political commitment to health for all ;
- — resource allocation ;
- — the degree of equity of distribution of health resources ;
- — community involvement in attaining health for all ;
- — organizational framework and managerial process.

(2) Social and economic indicators related to health :
- — rate of population increase ;
- — gross national product or gross domestic product ;
- — income distribution ;
- — work conditions ;
- — adult literacy rate ;
- — housing ;
- — food availability.

(3) Indicators of the provision of health care :
- — coverage by primary health care ;
- — coverage by the referral system.

(4) Health status indicators :
- — nutritional status and psychosocial development of children ;
- — infant mortality rate ;
- — child mortality rate (ages 1–4 years inclusive) ;
- — life expectancy at birth or at other specific ages ;
- — maternal mortality rate.

31. Various attempts have been made to reach one composite indicator from a number of the above indicators. For example, a " physical quality-of-life indicator " has been proposed ; it is a combination of the infant mortality rate, the life expectancy at the age of 1 year, and literacy (*6, 7*). To arrive at such indicators demands special technical skills and their application is therefore not easy.

32. The indicators mentioned in paragraph 30, together with some others that may be of interest, are dealt with in more detail in the following pages.

Health policy indicators

Political commitment

33. Political commitment is essential for the attainment of health for all. It is therefore the first of the fields for which indicators are considered here. But what are indicators of political commitment ? The seriousness of political commitment, for example, can really only be measured by the extent to which socially relevant development strategies such as primary health care are actually being implemented.

34. Indicators of political commitment are therefore likely to be of particular importance in the early stages of progress towards health for all,

when it is not yet clear to what extent countries really are committed. It is expected that at later stages a final commitment to health for all can be taken for granted in most countries, and emphasis can be shifted to monitoring changes in delivery of health care or health status.

35. The identification of suitable indicators of political commitment presents particular difficulties. In other fields it is usually possible to find quantitative indicators; the first stages in the establishment of political commitment, however, are, largely qualitative, and it would be artificial to require that the corresponding indicators be quantitative. The process can be considered under five aspects: declaration of high-level commitment; allocation of financial resources; degree of equity of distribution; degree of community involvement; and the establishment of a suitable organizational framework and managerial process.

36. A *declaration of high-level commitment* will vary in form according to the national situation. Essentially it will constitute a policy statement in favour of health for all from the highest level of authority, such as the head of state, the cabinet, party committees, etc. Endorsement of a health charter comes under this heading, and even a constitutional statement of the right of the citizen in respect of health, provided that this is being given an active policy interpretation. The indicator consists of a record of whether or not a relevant declaration exists, or perhaps of whether it is in preparation.

Resource allocation

37. It is at the budget level that governments' general statements of intent are usually translated into specific terms, and the budget is therefore of special importance as a basis for indicators of commitment. It is also at this level that quantitative indicators are feasible. Indeed, the single most important indicator of political commitment to strategies for health for all is the *allocation of adequate resources,* which may in fact necessitate substantial reallocation of resources.

38. Before indicators of financial resource allocation can be established, it will be necessary for a country to solve, in terms appropriate to its own situation, two problems of definition: which components are included under "health" and, within that, what is included under "primary health care". Without this it will not be possible to measure consistently changes in the proportion of national resources devoted to health and, within that, to primary health care. The difficulty in reaching such definitions lies in the fact that activities in many different sectors contribute to health.

39. In considering the basis for an indicator of the proportion of resources devoted to primary health care, expenditure on the provision of primary health care at the community level, for all the components decided upon at the Alma-Ata Conference, should be taken into account. However, since there are such great variations in the way primary health care is organized, it must be left to each national health authority to work out the most practical basis on which to construct a national indicator of expenditure on primary health care.

40. The following indicators are relevant for general use in connexion with financial resource allocation :

— proportion of gross national product spent on health services (distinguishing if possible capital from current expenditure, and government from private) ;

— proportion of gross national product spent on health-related activities (including education, community development, water supply, sanitation, housing and nutrition) ;

— proportion of total health resources devoted to primary health care.

These could be supplemented by the indicators based on quantities of specific resources (manpower, facilities, etc.) discussed below.

41. These indicators should preferably be based on governments' actual expenditures rather than on the budgetary provision. However, as data on the former often do not become available until one or two years after the event, it will usually be necessary to base the current indicators on the budget data, revising them later in the light of actual expenditures.

42. Further details concerning information for indicators, relating specifically to financial resource allocation, are to be found in Part 2 (paragraphs 174-177).

Degree of equity of distribution

43. As mentioned above, means and averages are less useful than indicators which accentuate the pattern of actual distribution—for example, the proportion and geographical distribution of the population that does *not* have reasonable access to clean water or is *not* covered by primary health care services, and major variations in health status between different groups. This identifies those who " have health "and those who do not. In practical terms this means disaggregation of data by geographical areas (e.g., capital city, other towns, rural areas), or by socioeconomic classification (e.g., occupational groups).

44. Therefore, indicators relating to the *degree of equity of distribution of financial resources,* facilities and manpower for health are important for assessing health achievements. Examples of such indicators are :

— the distribution of per capita expenditure on health between geographical areas or between capital city and the rest of the country ;

— the proportion of total health resources going to primary health care by region or district ;

— the ratios of hospital beds, doctors and other health workers to population in different parts of the country.

Community involvement in attaining health for all

45. One further field should be mentioned which is important in view of the nature of primary health care as a path to health for all, but in which only qualitative indicators may be possible—namely, *community involvement.* One indicator of the seriousness of political commitment is the level of community involvement in health decision-making and the

existence of effective mechanisms for people to express demands and needs : for example, the relative influence of representatives of political parties and of community-organized groups, such as trade unions, women's organizations, farmers or other occupational groups. The term " community involvement " has been given preference over " community participation " because it is not sufficient merely to participate, which may be simply a passive response ; there should be mechanisms and processes to enable people to become actively involved and to take responsibility for some decisions and activities jointly with health professionals.

46. Another indicator of both political commitment and community involvement is the *degree of decentralization of decision-making,* which facilitates more effective involvement at the local level and ensures that it will produce results that can be implemented.

Organizational framework and managerial process

47. If governments are politically committed they will establish a suitable organizational framework and managerial process for national health development. An assessment can be made as to whether a suitable organizational framework has been established through answers to questions such as the following :

— whether there is effective communication between different organizational levels and departments within the health sector and with other relevant sectors ;
— whether mechanisms exist to facilitate this communication and for joint policy and programming—such as national or district health development committees ;
— whether all technical divisions in a ministry of health participate in joint management of primary health care programmes to ensure full integration of services ;
— whether professional groups, medical and nursing schools and other university departments are adequately involved in research and service functions relevant to the development of primary health care.

48. The development and use of an *appropriate managerial process for national health development,* including monitoring and evaluation and related indicators, is in itself *an indicator of political commitment.* Information support is essential for this managerial process. If there is no information the magnitude of the problem can be conveniently obscured and no decision or action need be taken. At the other extreme, however, there is a danger of over-collection of information that is often irrelevant and never analysed or presented in a meaningful way. For example, it is often presented in an undigested form for the country as a whole and therefore does not help to measure inequalities in health. Data collection in itself, particularly when used as an alternative to action, is therefore not an indicator of political commitment ; only if it produces information that serves as a basis for action does it reflect the seriousness of commitment to health for all.

International political commitment

49. It can be seen that most of the above indicators of political commitment could be applied not only in individual countries but also, with some modification, to *activities of developed countries in support of primary health care* in other countries. A suggested indicator of the extent of such activities is the *number of developing countries with well-defined strategies for health for all, accompanied by explicit resource allocations, whose needs for external resources are receiving sustained support from more affluent countries.*

NOTE: For information requirements on health policy indicators, see paragraphs 174-177 in Part 2.

Social and economic indicators

50. The indicators covered in this section differ from those in the preceding and following sections in that they do not directly measure progress towards health for all unless this is interpreted very widely, but rather relate to influences on that progress from outside the health sector. They do not generally correspond to specific objectives and targets incorporated in national health development strategies, and it is suggested that they should generally be obtained from other national or international agencies rather than be calculated by the national health authorities. They are of great importance, however, in the interpretation of the indicators of health status and of the provision of health care described below. It is therefore necessary to indicate briefly their content and some of the problems which may arise in their interpretation.

Rate of population increase

51. Demographic factors—changes in the size of the population and its age and sex structure—are basic not only to the compilation of indicators but to all forms of planning in health and other fields. The standard vital events rates—*birth, death, and natural increase rates*—are the obvious indicators to use. The crude birth rate and death rate and other mortality rates are also useful indicators of health status, and are discussed further below. Their reliability will depend on the nature of the national data sources.

52. *Internal migration,* for example, may have a significant influence because of its connexion with urban growth and the special health problems of newly urbanized populations. Unfortunately no direct indicator of internal migration is usually available, and even the indirect indicator provided by differences in regional growth rates may only be available at long intervals. It may be possible to measure urban growth from administrative records (e.g., electoral lists, rationing records) and base an indicator on this.

Gross national product or gross domestic product

53. The size of the national economy is another background influence, comparable in importance with the size of the population, for which an indicator is required. This is usually expressed in terms of one of the national accounting aggregates such as the *gross national product* (GNP) or *gross domestic product* (GDP). (It does not greatly matter which of these related measures is chosen for national comparison, provided it is expressed

on a consistent basis from year to year ; international comparison would be easier if *one* measure is used.) These aggregates measure the total volume of national economic activity valued at current prices. A parallel series will usually be available at constant prices of the same base year—that is, adjusted to remove the effects of price changes. By dividing the total gross domestic product or gross national product by the population total we arrive at the *per capita gross domestic product or gross national product,* a very common general purpose indicator of the average income level.

54. As an indicator, the per capita GNP serves a number of purposes. First, it serves as a measure of changes in the total national output from which the share of health (however defined) must be drawn. For this purpose it can usefully be supplemented by an indicator of the part of these resources which is under the control of government, such as the total *government current expenditure expressed as a percentage of GNP.*

55. Per capita GNP can also serve as a general measure of human welfare—that is, of " health " in the very broadest sense. As such, it is subject to a number of shortcomings and ambiguities—for example, the inclusion of expenditure on armaments, and the exclusion of the services of housewives ; these are well known, and attempts are being made to develop better measures of welfare, but for the immediate future the per capita GNP is likely to remain the standard summary indicator.

Income distribution

56. Given the stress on equity in the definition of health for all and of primary health care, it is unfortunate that the per capita GNP cannot usually be calculated separately for districts or groups within a country. Independent measures of income distribution exist, but they are usually calculated infrequently and are subject to errors and ambiguities which make them unsuitable as year-to-year indicators. The same is usually true of indicators of special aspects such as the concentration of land ownership. Rather than attempt to maintain an indicator of equity in income distribution, therefore, it may be better to make occasional assessments of the situation as information becomes available. One source of such information is likely to be household sample surveys. These constitute one of the few sources which permit the linking of health variables (e.g., health expenditure, time lost through sickness) directly with income data. Efforts are now being made by the Statistical Office of the United Nations to increase the developing countries' capability for such surveys.

57. The last function of the per capita GNP is to serve as a background variable, since in practice many health variables are correlated with national income per capita. For international comparison national GNP estimates have to be translated into terms of some international currency. The most widely used aid for this purpose is the annual *World Bank Atlas,* though even this is subject to qualification and ambiguities. Efforts are being made to facilitate international comparison of GNP figures by basing them on relative purchasing power rather than exchange rates. In the meantime,

it is best not to place too much emphasis on small international differences in reported per capita GNP.

58. Proxy indicators for income distribution that have been used are occupational groupings, which reflect economic differentials, and the distribution of land, cattle or other possessions reflecting wealth and means of earning income. The amount of landlessness may be an important indicator in some communities.

Work conditions

59. Indicators which might be relevant in this context in some countries are work availability, the level of unemployment or underemployment, the percentage of women in the labour force, and the prevalence of disability preventing gainful employment. However, in countries where the majority are self-employed or in the informal nonpaid sector these indicators are less useful.

60. Also relevant in some countries may be the *dependency ratio,* reflecting the age structure of the population and denoting the number of " dependent " persons (i.e., those under 15 years of age and those aged 65 or more) per 100 persons aged 15 to 64. This indicates the proportion of the population not having a wage-earning capacity. However, in many countries the nature of society is such that the age structure indicates neither potential economic activity nor dependency.

Adult literacy rate

61. Progress towards health for all is likely to be strongly influenced by two social factors which are not generally regarded as part of the health sector—education and housing. One possible indicator of the contribution of education to health is the *literacy rate,* most commonly defined as the percentage of the population aged 15 and over able to read and write in any language. The data for this are usually obtained during the population census, and the indicator is therefore subject to the drawback that it can only be updated at long intervals ; moreover, self-reported literacy is not the same as functional literacy. The literacy rate of women is particularly important for health since it is they who most often provide primary health care in the home. This becomes still more important if the concept of literacy is extended to include " health literacy ", namely an elementary understanding of nutritional and health needs and of how to prevent or control common health problems.

62. An alternative indicator uses the number of *pupils enrolled in educational institutions expressed as a percentage of the estimated population aged 5 to 19.* This can initially be prepared as an aggregate indicator ; refinements can be introduced later—such as a distinction between primary, secondary and tertiary education. Enrolment data are subject to drawbacks, since they do not reflect the level of attendance, but they represent easily available administrative statistics which can be frequently updated. The question of *actual attendance,* however, may be of significance, particularly in relation to girls. Absenteeism from school can

itself be an indirect indicator of sickness among children ; but in some societies, particularly at certain periods of the year, it may result from poor enforcement of child labour laws or, with regard to girls, domestic work or help in child-rearing.

63. Possible supplementary indicators, reflecting the quality of education, are the *number of pupils per teacher* and the *expenditure per pupil.* Educational indicators are more meaningful for health purposes if differentiated by sex, since the literacy of women is a more important influence on primary health care than that of men ; data for this purpose are available in most countries.

Housing

64. The most commonly available indicator of the adequacy of housing is *the number of persons per room* (or alternatively the proportion of households for which the number of persons per room falls below some national standard). Housing indicators should take into account the nature of the accommodation in terms of its size, its insulation against extremes of weather, the exclusion from it of disease-carrying insects and rodents, and the availability of water and sanitary facilities. The absolute value of the indicator is not so important, since it must be interpreted in the light of the census practice in including or excluding certain types of room and of cultural and climatic factors ; rather, the interest is in changes in the indicator over time.

Food availability

65. It is evident that food and nutrition have an important influence on health status, particularly for low-income groups. In a later section indicators are suggested for the nutritional status of the population. It would be desirable to complement these with indicators of the national food supply, in total and for different groups in the population. No single indicator at present available is wholly satisfactory for this purpose. The *per capita energy* (" calorie ") *availability,* calculated from food balance sheets which take account of local food production, imports, exports, wastage and diversion for nonhuman use, is the best available indicator of total food availability, but it must be interpreted with caution since it takes no account of seasonal variations, differences between income groups, or patterns of food distribution within households. Supplementary information on these points can often be obtained from food consumption surveys or from household expenditure surveys, but not on a basis which can provide a continuous indicator. Where the national accounts record private expenditure on food in detail, at constant prices, this may also provide useful supplementary information, though, again, at the aggregate level.

NOTE : For information requirements on social and economic indicators, see paragraphs 178-182 in Part 2 below.

Indicators of the provision of health care

66. It would be convenient to have a composite indicator of the provision of health care so that one could say, for example, that 75% of the population is provided with good-quality health care. This would provide an indicator of " coverage " in the most general sense of the word. But no

satisfactory indicator of this kind exists at the moment, and it is necessary to break down this general concept of " coverage " or " health care provision " and try to construct good indicators for each aspect of it. One way of doing this is to separate different levels of the health system—for example, primary health care as distinct from referral levels (i.e., hospital or polyclinic care). Another is in terms of different functions—maternal and child health, for example, as distinct from general curative care. Another type of breakdown distinguishes different measures of provision in terms of such concepts as availability, accessibility, and utilization. Usage under these headings is not fully standardized, but the following may be useful :

— availability : ratio between the population of an administrative unit (district, etc.) and the health facilities and personnel assigned to it (e.g., population per health centre, doctor, traditional birth attendant) ;

— accessibility : number or proportion of a given population that can be expected to use a specified facility, service, etc., given certain barriers to access, which may be physical (distance, travel time), economic (travel cost, fee charged), or social and cultural (caste or language barriers) ;

— utilization : number or proportion of the population using a given service ; this can be related to the number or proportion needing the service.

67. The main fields for which indicators are suggested are discussed here only briefly. Their technical properties and the data sources involved are described in Part 2 (paragraph 125 *et seq.*).

Availability

68. Availability, as defined above, is an imperfect measure of the provision of the health services, and needs to be supplemented by other indicators. It is, nevertheless, worth maintaining indicators of availability, because the necessary information is usually available from administrative and other sources.

Physical accessibility

69. Physical accessibility of services is a first priority. Each country will have to decide how to define what is " accessible " : for example, one hour's walking time, or half an hour's travel by ox cart. This may vary for different parts of the country and will be different for different types of services. Supervision and care during childbirth, for example, may have to be much nearer home.

70. For each of the elements of primary health care, physical accessibility objectives need to be defined. For example, what are acceptable conditions for clean water supplies ? It is useful to select a few priority services relevant to primary health care—for example, water, maternal and child health care, and first-level curative care—and establish physical accessibility objectives for each of these. Coverage can then be assessed by measuring the proportion of the population within an acceptable distance of these services in different geographical or administrative areas. This is not

difficult to do, allowing for some inaccuracies. Informed approximations, based on as much demographic information as possible, are of considerable value in arriving at overall estimates of the proportion of the population " covered " by primary health care services

71. Another aspect of physical accessibility and coverage relates to referral facilities. This is described below in paragraphs 91-94.

Economic and cultural accessibility

72. Economic accessibility is the ability of the individual or the community to cover the cost of care ; if a service is available but either the individual or the community cannot afford it, then it is not accessible.

73. Cultural accessibility is the acceptability of the services to those for whom they are provided—for example, in some societies, female health workers to care for women. Acceptability also implies that services are seen to be relevant to priority needs, or offer care of adequate quality.

Utilization of services

74. Utilization of services—or actual coverage—is expressed as the proportion of people in need of a service who actually receive it in a given period, usually a year ; for example, the proportion of children at risk who are immunized, or the proportion of pregnant women who receive antenatal care or have their deliveries supervised by a trained attendant. In estimating actual coverage, countries have to specify the minimum level or standard of care acceptable as coverage. In some cases facilities exist but lack of drugs or poor-quality care results in the people not using the services. Other reasons for nonutilization are that facilities may be open at hours of the day when people will not come because they are occupied in the fields or factories. Also, people may be attracted by the prestige of a more distant hospital, and may use it for care that could have been provided by local primary health care facilities.

75. The number of people who *actually use* the service can be obtained relatively easily with properly designed recording systems, especially if voluntary health workers are also integrated into the system. The measurement of this type of coverage reflects both geographical and other kinds of accessibility, such as economic and cultural. Information about those who use the services, by comparison with the total population, can provide some information, by inference, about those who *do not use* them. Information on nonusers and the reasons for nonuse can really only be obtained from community-based surveys.

Quality of care

76. Ideally, indicators of coverage should be supplemented by indicators of *quality of care,* although utilization is also a reflection of the quality of care. Quality control, however, is complex and requires a profile of a number of indicators. It is essentially required for managerial and supervisory functions, particularly at the district or provincial level. A number of indicators can be developed to be incorporated into a built-in monitoring system using a checklist and a simple scoring system.

Coverage by primary health care

77. As will be seen from paragraph 66 above, coverage is really meaningful only if it relates to specific types of services. It is most meaningful when it relates to those services that the national health strategy aims at providing. The following indicators relate to the essential components of primary health care included in the Declaration of Alma-Ata (*3*).

Information and education concerning health

78. It is often necessary to bring about change in people's attitudes and behaviour in order to improve their health. To succeed in this, people must have an understanding of prevailing health problems and of appropriate methods of preventing and controlling them. This has been termed " health literacy ". It would be useful to have *an indicator of health literacy,* but as yet no such indicator exists. Some suggested indicators of the effectiveness of dissemination of information for such an educational process might be the number of mass-media outlets (e.g., newspapers, radio programmes, television or films) and the extent to which health information is actually disseminated through them (e.g., number of hours per week of health radio programmes, the use of peak-times, etc.). Indicators of provision and dissemination of information must be completed by indicators of access, such as the proportion of the population owning a radio or television set or reading newspapers. In developing countries the radio is usually the most important of the media in this context.

79. The effectiveness of other channels of communication and whether they are used to disseminate information that would enlighten people on health matters could also be assessed—for example, political parties, women's organizations, schools, farmer's associations, etc. The only way of assessing " health literacy " is to carry out community surveys. It must be emphasized, however, that a high degree of understanding of health problems and ways of solving them is not in itself an indicator of attitudinal and behavioural change. Such changes are not easy to measure ; they, too, would have to be assessed by community surveys.

Promotion of food availability and proper nutrition

80. Relevant food and nutrition indicators are mentioned in paragraphs 65 above and 97-101 below.

Water and sanitation

81. The most useful indicators here are those which express the *degree of accessibility* for the population of water and sanitation facilities. This will depend on definitions of accessibility expressed by countries.

82. One indicator used is the percentage of households with a sufficient volume of water for drinking purposes and for keeping the house and its immediate surroundings clean. However, the existence of a water outlet in a household is no guarantee in itself that water will always be available or safe. Also, a water outlet requires drainage facilities ; otherwise the provision of water can have adverse health effects.

83. In the absence of a water outlet in households, another indicator is the *availability of a water standpoint or protected well* within given walking time from the home—for example, 15 minutes.

84. The proportion of households with safe or adequate facilities for waste disposal can be used, but what is regarded as " safe " and " adequate " needs to be specified.

Maternal and child health

85. Birth and fertility rates are mentioned below, in paragraph 111. Fertility rates, ages at which mothers have children, and birth intervals are all indicators of " reproductive health ". For example, experience has shown that mortality is high among infants born to mothers within 18 months of their previous delivery or to mothers below the age of 18 years. As mentioned in paragraph 110, maternal mortality is one indicator of the level of maternal care. Infant and child mortality rates reflect infant and child care but, as mentioned in paragraphs 103-107 below, they are also useful indicators of socioeconomic development in general. In addition to such " measures " of maternal and child health, *indicators* can be used *that reflect the accessibility and utilization of maternal and child care*—for example, the percentage of pregnant women receiving antenatal care ; it would, however, be necessary to define what is meant by " antenatal care " — for instance, how many antenatal visits are an acceptable minimum, and *what conditions* have to be screened during these visits. Attendance at birth by trained personnel is equally useful, but it is necessary to agree on what constitutes " trained " personnel. For example, both for the quality of antenatal care and for training, it is necessary to define certain minimal standards—such as the duration of labour beyond which the woman should be referred to more skilled care, and the ability to deal hygienically with the infant's umbilical cord. Maternal and infant care immediately after birth are obvious components of maternal and child health but, again, it is necessary to define what this means. Access to information, guidance and the supplies required for family planning, the percentage of the population using the various methods of family planning, and access to preventive and curative care for subfertility are relevant in many countries. Adequate care of infants, young children and schoolchildren is another essential element in infant and child health, but it is again necessary to define what is " adequate ". For example, the percentage of children who die at ages of 1–4 years who were seen by the health service during their last illness is a useful indicator of health service coverage with child care.

Immunization

86. The indicator used is the *percentage of children at risk immunized* against the major infectious diseases of childhood that can be prevented by immunization. When the number vaccinated is low, this indicator can be expressed by the percentage of children *not* immunized, in order to evoke action. This is certainly important information, but it is far from easy to obtain it. Ideally, all immunizations should be registered at the time of immunization ; in practice, local circumstances and work pressure may

make this difficult. When the immunization leaves a scar, as with BCG, scar surveys can help to provide this information. In other cases, household surveys may be necessary. Sample serological surveys can indicate the percentage of children with a certain minimum antibody titre, but for such surveys it is necessary to convince parents to bring their children for the removal of blood, and it is also necessary to have the requisite laboratory facilities. For these reasons serological surveys are usually limited to the study of special problems.

87. It is useful to have a composite indicator of adequate coverage by immunization. However, to do so would mean deciding what kinds of immunization and how many doses of a particular vaccine are acceptable as adequate coverage. While the basic indicator of the primary objective of immunization activity would be the reduction of morbidity and mortality from major infectious diseases of childhood, the information for such an indicator would depend on good baseline data and a reliable reporting system. If these are not available, the percentage of children under 1 year of age who are " fully immunized " can be used ; that is, use can be made of sampling and survey techniques. The term " fully immunized " indicates a minimum of three contacts between the health service and the child.

Prevention and control of endemic diseases

88. Since the control of endemic diseases is important for health, it would be useful to have an indicator to reflect the degree of such prevention and control. Yet it is not easy to measure progress in this area with respect to all the diseases concerned. Even if it were possible to make fairly accurate diagnoses when people come for care, using lay-reporting methods in some countries, mass screening would be necessary to arrive at the total load of the diseases concerned, including those people who do not come for care. This is hardly feasible for most countries. For these reasons, any attempt to use indicators of the prevention and control of locally endemic diseases will have to rely on a high degree of selectivity, only one or two diseases of major public health importance being considered. A possible alternative is the intensive observation of a limited number of selected geographical areas.

Treatment of common diseases and injuries

89. This, too, is one of the essential components of primary health care, and it would be useful to know to what extent common diseases and injuries receive adequate treatment. Once more, high selectivity is advised, restricting the assessment to one or two of the most common diseases and injuries. For example, with respect to diarrhoea the assessment could be based on the use of oral rehydration ; or, with respect to home accidents, access to first aid that cannot be provided by the family itself. As for more serious accidents, one indicator of access to adequate care could be the percentage of injured people arriving in a hospital within, say, one hour of sustaining the injury. However, in many countries the difficulty of keeping the records needed for computation of such a percentage would make this indicator one of theoretical rather than practical value.

Provision of essential drugs

90. Indicators of the provision of essential drugs are the *existence of a selected list* of such drugs for use in primary health care and the *availability of such drugs* at the primary health care facility *whenever they are needed throughout the year*. Periodic surveys of primary health care facilities carried out as part of the routine supervisory function can provide information on the number of facilities with or without adequate supplies of priority drugs and vaccines at the time of the visit. In organizing such surveys it has to be remembered that drugs are often available sporadically, depending on the period of the year (for example, shortly after the beginning of a new budgetary period) as well as on the efficiency of the logistic system.

Coverage by the referral system

91. *The accessibility and geographical distribution of referral facilities* are indicators of adequacy of support for primary health care. Like accessibility of primary health care, norms of the physical accessibility of referral facilities need to be defined by each country—for example, emergency referral to be no more than one or two hours' travel time (usually vehicle transport) from either a peripheral health facility or a village settlement. The indicator used would be the proportion of the population within this range.

92. Economic and cultural accessibility of the referral system could be considered in the same way as for primary health care. For example, is the cost of hospital care within the economic means of patients or communities? As for cultural acceptability, people may not wish to go to hospital because the atmosphere is alien to them; the hours of clinics may not be convenient; cultural customs may not be observed—e.g., in connexion with childbirth or food preparation; the concentration of dying patients may create an impression that hospital wards are antechambers to death.

93. Actual utilization of referral facilities and the quality of care provided in them are yet more complex. Hospital utilization data in respect of inpatient and outpatient care can be analysed through routine reporting, through *ad hoc* studies and, even better, by community surveys or household questionnaires. However, these are costly and time-consuming and may not be justified as a priority. If utilization studies are undertaken they can be so designed as to show whether patients are being admitted in relation to defined medical criteria or whether social privilege is the determining factor.

94. As is the case for primary health care, it is useful to have a checklist of the essential components of referral facilities. For example, for a first-line hospital this could be support to primary health care workers in relation to health education, nutritional problems, and the provision of safe water and sanitation. It could also include the provision of paediatric, obstetric, gynaecological, surgical and medical care, and the related laboratory and radiodiagnostic facilities, as well as the corresponding support for primary

health care workers in the preventive, diagnostic, curative and rehabilitative aspects of care.

Manpower

95. The availability of different categories of health workers performing different functions is a prerequisite for coverage by health care. The geographical distribution of these different categories of manpower and the ratios between them are important. This information can also serve as an indirect indicator of resource allocation patterns and can be used where information on actual expenditure is difficult to obtain.

96. The following indicators are relevant :

— the ratios of population to different kinds of health workers, particularly by geographical location, such as province, district, urban or rural ; for example, the population ratio to primary health care workers of various kinds, including doctors, dentists, nurses, pharmacists, etc. In some countries it may be useful to distinguish between those within the formal health system and other health workers. These ratios can be " mapped " for the country to illustrate variations around the average. The *overall national indicator* used might be the proportion of the total population with *less than* average doctor/population ratios or primary health care worker or midwife/population ratios, etc. ;
— the ratio between various types of health workers, such as doctors to nurses or to other categories of health workers ;
— the ratio between all health workers in primary health care on the one hand and the rest of the health system on the other ;
— the number of schools which have revised or reformed their curricula to adapt them to the needs for health for all and primary health care.

NOTE : For information requirements on the indicators related to the provision of health care, see paragraphs 183-214 in Part 2 below.

Basic health status indicators

Nutritional status and psychosocial development

97. Nutritional status is a positive health indicator. Anthropometric measurements to assess growth and development, particularly the physical growth and development of young children, are the most widely used indicators of nutritional status in a community. The comparison of weights and heights in adults is less useful ; while it can give an indication of current nutritional status, it does not reflect the degree of growth retardation experienced during childhood.

98. Birth weight can be an important indicator of community nutrition ; the indicator could be expressed as the number of children per 1000 live-births whose birth weight is lower than a certain norm, such as 2500 grams. However, low birth weight may also be related to certain diseases, such as malaria, and to specified nutritional deficiencies such as endemic goitre. Where coverage of supervised births by trained personnel is low, it may be difficult to collect data on birth weight.

99. Measures of nutritional status commonly used are weight-for-age, weight-for-height and height-for-age of young children. There are advantages and disadvantages in all three methods, and none can be recommended singly. For example, weight-for-age reflects both stunting of growth and consequently long-term undernutrition, as well as current undernutrition. It is useful for monitoring the nutritional status not only of individuals, but also of communities, by identifying the proportion of children with a weight-for-age less than, say, 80 % of an agreed standard (*8,9*). Changes in this indicator can be observed over a short period of time. However, there are problems in some societies in obtaining accurate ages of children. This constraint also affects the estimation of height-for-age, which is an indicator of increase in physical stature, and therefore of long-term nutritional influences. Genetic variations in height have to be considered when making comparisons. Weight-for-height is an indicator of current nutritional status ; it reflects the extent to which the individual is acutely malnourished. It can also be used for monitoring the nutritional status of communities at a given time, by identifying the proportion of children below an agreed standard. Changes can be observed over a short period of time. However, in infants and young children up to about 2 years of age it is not easy to measure height accurately. The standardization of measurement of both height and weight and the training of people in the use of standard methods adopted are necessary to ensure consistency. In spite of the difficulties mentioned above, if individual monitoring of nutrition is carried out routinely through child care services with a relatively good coverage it is quite feasible to monitor trends in the percentage of children below a certain nutritional status.

100. In all three methods mentioned above, comparisons are made with a normal range which may be locally defined or based on international standards. Defining the normal standard poses problems for some less developed countries where suboptimal nutrition interacts with genetic differences. Care has to be taken in using international standards, although in general it is believed that most young children of the world, regardless of genetic origin, in fact approximate to an optimal weight-for-age or weight-for-height, given adequate nutrition, even though there are genetic variations in height.

101. The mid upper-arm circumference has been widely used in recent years to assess nutritional status. This is particularly useful in relation to height. It does have certain disadvantages in terms of accuracy. This indicator is therefore more useful for screening individual children and for rapid community diagnosis than for monitoring individual child growth.

102. *Indicators of the psychosocial development of children* are at least as important as those of their physical growth ; however, ways of arriving at these indicators have to be determined according to the population concerned, because they are very culture-specific. Indicators will therefore have to be developed at country or even provincial or district level.

Infant mortality rate

103. The infant mortality rate is the number of deaths of infants up to the age of 1 year per 1000 live-births in a given year. It is a useful indicator of the health status not only of infants, but also of whole populations and of the socioeconomic conditions under which they live. In addition, the infant mortality rate is a sensitive indicator of the availability, utilization and effectiveness of health care, particularly perinatal care. There is a great difference in the infant mortality rate as between the least developed and the most developed countries. In the least developed countries the rate can be more than 200 per 1000 live-births, whereas in many developed countries it is less than 15 per 1000 live-births. There are also wide variations within countries—for example, between different geographical areas, between urban and rural areas, and between population groups at different socioeconomic levels.

104. Although the infant mortality rate has been recognized for many years as one of the most important health indicators, there are serious problems in collecting the information required for its calculation in many of the less developed countries. The information cannot usually be gathered through health service information systems. Civil registration of deaths is often incomplete or nonexistent, particularly in rural areas, where many infants dying during the first week of life have not even been registered as having been born. For this reason, the rates used in some countries—based on civil registration or hospital data and consequently covering mostly urban areas, which represent less than 10 % of all infant deaths—are biased to reflect the more privileged in the population. Infant mortality rates can often be estimated or collected from censuses or fertility surveys, which are carried out in many countries. Sample surveys or demographic monitoring done by the census bureau of statistics would allow disaggregation of information to show differences within countries.

Child mortality rate

105. The child mortality rate is the number of deaths at ages of 1–4 years in a given year, per 1000 children in that age group at the mid-point of the year concerned. Childhood mortality thus excludes infant mortality. More than infant mortality it reflects the main environmental factors affecting the health of a child, such as nutrition, sanitation, the communicable diseases of childhood, and accidents occurring in and around the home. It reflects, even more than the infant mortality rate, the level and amount of poverty and is consequently a sensitive indicator of socioeconomic development in a community. Whereas the infant mortality rate may be more than 10 times higher in the least developed countries than in the developed countries, the child mortality rate may be as much as 250 times higher. This indicates the magnitude of the gap and the room for improvement, as the great majority of such deaths can be prevented with improved socioeconomic conditions. However, as for infant mortality, information on child mortality is currently difficult to collect in many developing countries except through sample surveys or sample death registration.

Under-5 mortality rate

106. The mortality rate of all children under 5 years can be used to reflect both infant and child mortality rates. This has certain advantages. The use of the infant mortality rate alone may not draw sufficient attention to the high mortality rate among older children. The problems of malnutrition, in particular, may not be given sufficient attention as a causative factor, especially in those countries where the child in the second year of life is most vulnerable to malnutrition.

107. It is relatively easy to arrive at the proportion of total deaths occurring in the under-5 age group. This is known as the *proportionate mortality of the under-5 age group.* Deaths of under-5s account for a very high percentage of total deaths in some less developed countries, while there are very few in the more developed countries. This indicator also reflects the higher birth rates and the greater proportion of population in this age group in less developed countries; the proportion of all deaths accounted for by the deaths in children under 5 is therefore an indicator reflecting high child mortality rates, high birth rates, and shorter life expectancy.

Life expectancy at a given age

108. The life expectancy of a population at a given age is the average number of years lived beyond that age by all those who have reached that age. For example, life expectancy at birth is the average number of years lived by all those in the population concerned born alive. Life expectancy at the age of 1 year is the average number of years lived beyond the age of 1 by all people who have reached the age of 1. Life expectancy is a good indicator of socioeconomic development in general. The life expectancy at birth ranges from less than 40 for the least developed countries to more than 70 for developed countries. Differences between the two sexes regarding life expectancy may be significant. Life expectancy at birth is highly influenced by the infant mortality rate where that is high. Life expectancy at the age of 1 excludes the influence of infant mortality, and life expectancy at the age of 5 excludes the influence of child mortality. Using life expectancy as an indicator has the advantage of being a source of pride to countries as it progressively increases. However, its calculation is not at all easy, since it depends on life tables constructed from a knowledge of the age structure of the population and the deaths that have occurred in each age group.

109. Life expectancy is an indicator of long-term survival. In this respect it can be considered as a positive health indicator. The question arises whether shorter-term survival rates could not be used as indicators in place of certain mortality rates, since these survival rates have to be calculated in any event in order to arrive at life expectancy. For example, the indicator could be expressed as the proportion of all live-born infants who remain alive at the age of 1 or 5, or the proportion of children who, having reached the age of 1, remain alive until the age of 5. These "survival rates" could then be considered as positive indicators. However, they may not have the same power to lead to action as the more dramatic mortality indicators.

Maternal mortality rate

110. This rate reflects the risk to mothers during pregnancy and childbirth. It is influenced by general socioeconomic conditions, nutrition and sanitation, as well as by maternal health care. It is expressed by the number of deaths attributed to complications of pregnancy and childbirth occurring over a year, divided by the total number of live-births in the year. It is often expressed as the number of maternal deaths per 1000 live-births. Deaths due to abortion are sometimes excluded. Rates range from 30 per 1000 in the least developed countries to less than 0.1 per 1000 live-births in the developed countries. Like infant and child mortality rates, this rate is difficult to obtain when only a small proportion of the births and deaths are recorded—for example, those occurring in health facilities. Where partial civil registration of deaths is carried out, the determination of a specific cause of death may be a constraint, but the use of lay-reporting methods has been found effective, as mentioned in paragraph 25. Also, the training and use of traditional birth attendants in primary health care can increase the coverage and provide opportunities for collecting this information, at least on a sample basis.

111. The crude *birth rate* is an important health-related indicator. It is expressed as the number of births in a year per 1000 population. High birth rates together with short average birth intervals are associated with higher mortality in both mothers and children. Closely related is the *fertility rate*, which reflects the number of children an average woman would have in her lifetime, given the current level of fertility. More refined, and more directly health-related, is the age-specific fertility rate, which is the number of births by women of a given age group (usually 5-year age groups) in a given year, divided by the number of women in that group.

Further health status indicators

112. As countries make progress in terms of social and economic development, and as their health systems develop accordingly, they may wish to use further indicators of health status. The following are some additional suggestions for such indicators.

Disease-specific mortality

113. Mortality rates can be computed for specific diseases such as communicable diseases. The rates for diseases for which immunization exists are particularly useful, as they indicate the magnitude of the preventable mortality. *The proportionate mortality rate from communicable diseases* is also often used. It expresses the number of deaths from these diseases as a percentage of all deaths. The computation of these rates depends on reasonably accurate diagnosis of the cause of all deaths suspected of belonging to the group of communicable diseases, and this is a considerable disadvantage if the health system is not well developed. High selectivity is therefore once more advocated.

114. As countries begin to extricate themselves from the burden of communicable diseases, they are liable to be increasingly beset by such other problems as cancer, cardiovascular diseases, accidents, suicides and mental diseases, this being to some extent an effect of the different age

structure of the population. Even if the principle of high selectivity is accepted, the calculation of specific death rates is problematic, since mortality figures would have to be based on accurate diagnoses in relation to the international classification of diseases. This may require the support of pathology facilities in hospitals, and even were they available, deaths outside the hospital service would not be covered.

Morbidity

115. To describe health in terms of levels of mortality only is misleading. Mere survival is not an adequate indicator of health and does not reveal the burden of ill-health in a country. *Morbidity can be described in terms of the incidence and/or prevalence of certain diseases or disabilities.* It is usually expressed as a rate : the number of cases of disease per 1000 persons at risk. The most accurate way of assessing morbidity rates is through epidemiological surveys, but reporting cases through health systems surveillance does provide some indication of the relevant magnitude of the disease incidence as well as trends in control or prevention, and it can provide information on morbidity patterns in different parts of the country. The limitation of the health information support has already been mentioned above, but in addition there are problems of inaccuracy of diagnosis. This may be particularly difficult for nonprofessional health workers, even if trained in some kind of " symptom reporting ", e.g., cough, fever, diarrhoea. Another problem may be limited diagnostic means, such as laboratories and X-ray facilities. A further problem is that many of the chronic diseases may not reach the health services and may only be identified through community or household surveys. However, such surveys have to be organized in such a way as to take account of perception of disease in the community concerned.

116. If a country wishes to use morbidity indicators, it is suggested that it select the five or six *most prevalent diseases* and institute as a first step an appropriate method of monitoring the incidence or prevalence of one or two that it considers most important—for example, cancer, cardiovascular disease or mental illness. In some societies *overnutrition* is a much greater health problem than undernutrition, particularly in adults. Weight-for-height measurements are used for estimating overnutrition, although opinions still differ as to the optimal correlation between weight and height at different ages. *Absenteeism* may reflect physical or mental illness in specific local circumstances, but caution in its interpretation is required because it may also result from social causes.

117. A recently developed indicator of *oral health* is the " DMF " indicator, i.e., the average number of decayed, missing or filled teeth. This indicator reflects the degree of dental disease and the provision of dental care : for example, an average of not more than three decayed, missing or filled teeth at the age of 12 years has been proposed by WHO as an acceptable level of oral health.

Disability

118. In recent years indicators of disability have been proposed. For example, an important disability in some countries is the prevalence of blindness. Motor disability indicators are more likely to be feasible in countries with highly developed health systems, where statistics can be derived from centres for physical rehabilitation. However, there are examples of the successful use of schoolteachers to elicit the information required with respect to disability among schoolchildren.

Social and mental wellbeing

119. WHO's Constitution defines health as a "state of complete physical, mental and social wellbeing...". As is the case for physical wellbeing, as long as valid positive indicators of social and mental wellbeing are scarce it is necessary to use *indicators of social and mental pathology.* Examples of possible indicators are the rate of: suicide, homicide, other acts of violence and other crime; road traffic accidents; juvenile delinquency; alcohol and drug abuse; smoking; consumption of tranquillizers; and obesity. Many of these phenomena are not limited to the more affluent countries and, indeed, a few are becoming major problems in some less developed countries which are experiencing relatively rapid economic development characterized by industrialization and rural–urban migration. The main problems in using such indicators are methodological. By what criteria are alcohol and drug abuse or juvenile delinquency defined, and how can they be measured? Alcohol abuse and smoking could be assessed from the analysis of national expenditure on alcohol and tobacco. Homicide and acts of violence can be deduced from police figures and from the number of patients with injuries due to violence reaching health care facilities. Information on the consumption of tranquillizers can be derived either from routine reporting from pharmacies or sample surveys of pharmacies. In deciding whether to use the above indicators, selection of priorities is again the important consideration, bearing in mind the feasibility and cost-effectiveness of collecting information.

120. In relation to these indicators of social disease, some countries may wish to focus attention on more positive indicators of the *quality of life* of their people. Quality of life is relative to socioeconomic circumstances. In some societies the availability of adequate food, water, sanitation, shelter, clothing and work could be the basis for assessing the quality of life. To this could be added the availability of educational, cultural and health facilities, a satisfactory social and sexual life, and adequate environmental safety and comfort. In certain societies opportunity for cultural, leisure and sporting activities, or the proportion of the population engaged in such activities at different ages, have been suggested as indicators of the quality of life. But how are such indicators arrived at? Obviously more work is needed to define psychosocial health and the quality of life, which may be very culture-specific. When these aspects have been further clarified it will be possible to use indicators that measure their attainment more specifically. At present the possibility of using individuals' subjective assessments of wellbeing—their perception of wellbeing, contentment, security, etc.—as

indicators of quality of life is also being discussed; this approach could possibly be appropriate for all cultures, but requires further refinement if it is to be useful.

NOTE: For information requirements on health status indicators, see paragraphs 215-295 in Part 2 below.

Selected list of indicators for use at the global level

121. If the main problem within countries is the collection and analysis of information, it is evident that great circumspection is required in making international comparisons. Any selection of indicators for use at the global level implies the commitment of countries individually, as well as collectively in regional groupings, to use at least these indicators and to provide the necessary information on them.

122. If international comparisons are difficult, so are international aggregations. Average global values of indicators have little meaning. For this reason, monitoring and evaluation at the global level will be based on the *number of countries* in which certain indicators comply with predetermined norms.

123. Information has to be provided by all countries for the development of a global indicator to be possible. For it to be useful, all countries also have to be able to use the global indicator. The list, at global level, has therefore to be kept very short, though many countries may want to use additional indicators in keeping with their needs and capacities.

124. The following list of 12 global indicators, which is minimal for the reasons given above, was adopted by the Thirty-fourth World Health Assembly in 1981 (*1*, Section VII, para. 6).

The number of countries in which:

(1) *Health for all has received endorsement as policy at the highest official level,* e.g., in the form of a declaration of commitment by the head of state; allocation of adequate resources equitably distributed; a high degree of community involvement; and the establishment of a suitable organizational framework and managerial process for national health development.

(2) *Mechanisms for involving people in the implementation of strategies have been formed or strengthened, and are actually functioning,* i.e., active and effective mechanisms exist for people to express demands and needs; representatives of political parties and organized groups such as trade unions, women's organizations, farmers' or other ocupational groups are participating actively; and decision-making on health matters is adequately decentralized to the various administrative levels.

(3) *At least 5 % of the gross national product is spent on health.*

(4) *A reasonable percentage of the national health expenditure is devoted to local health care,* i.e., first-level contact, including community health care, health centre care, dispensary care and the like, excluding hospitals. The percentage considered "reasonable" will be arrived at through country studies.

(5) *Resources are equitably distributed,* in that the per capita expenditure as well as the staff and facilities devoted to primary health care are similar for various population groups or geographical areas, such as urban and rural areas.

(6) *The number of developing countries with well-defined strategies for health for all, accompanied by explicit resource allocations, whose needs for external resources are receiving sustained support from more affluent countries.*

(7) *Primary health care is available to the whole population, with at least the following :*

— safe water in the home or within 15 minutes' walking distance, and adequate sanitary facilities in the home or immediate vicinity ;

— immunization against diphtheria, tetanus, whooping-cough, measles, poliomyelitis, and tuberculosis ;

— local health care, including availability of at least 20 essential drugs, within one hour's walk or travel ;

— trained personnel for attending pregnancy and childbirth, and caring for children up to at least 1 year of age.

(8) *The nutritional status of children is adequate, in that :*

— at least 90 % of newborn infants have a birth weight of a least 2500 g ;

— at least 90 % of children have a weight for age that corresponds to the reference values given in Annex 1 in this volume.

(9) *The infant mortality rate for all identifiable subgroups is below 50 per 1000 live-births.*

(10) *Life expectancy at birth is over 60 years.*

(11) *The adult literacy rate for both men and women exceeds 70 %.*

(12) *The gross national product per head exceeds US $ 500.*

2. Information Requirements

Introduction

125. Part 2 deals with methods of information collection and analysis commonly used for establishing the various types of indicators likely to be selected to monitor progress towards health for all. Standard sources and techniques to obtain the data are reviewed, and questions related to information collection for specific indicators are described in brief summaries. Many countries still lack reliable health information systems to provide the data needed to calculate these indicators by standard methods. Therefore, Part 2 describes the data sources which are potentially available in most of the developing countries and were mentioned in the overview in paragraphs 14-29 above.

126. In assessing the availability of information for the construction of indicators, it is important to take full and realistic account not only of the sources in the health sector but also of the work of *national and even international agencies outside the health sector.* This is particularly true in the demographic, social and economic fields.

127. In using indicators for the monitoring of health progress, information is required for four types of comparison, namely :

(*a*) comparison of the current level with the numerical target set for the year 2000 and for intermediate time points ;

(*b*) comparison of the same population between different periods of time ;

(*c*) comparison among different population groups within a country ; and

(*d*) comparison among countries.

The main emphasis in Part 2 is on the information requirements for the first three types of comparison. Nevertheless, as far as available, internationally accepted definitions and procedures are described, as their use, with adaptations as necessary to suit the conditions of a country, will facilitate, first of all, comparisons within a country, then among a few countries, and, finally, among all countries.

128. Two fundamental problems relating to the uses of indicators and the degree of precision needed might be mentioned at the outset. In order to monitor progress towards health, not only must baseline levels be established but also changes from these levels over time must be measured. The need to measure change rather than absolute levels puts a greater demand upon the accuracy of the data sources, and, where a community survey is envisaged as the data source, will demand correspondingly larger sample sizes. For example, in a community where infant mortality is high, a rate based on 10 000 households might suffice for the appraisal of the general level of health conditions surrounding infants, but would be inadequate to establish where a reasonable change had been brought about since the time of a previous survey.

129. The second problem is the need for indicators to be applied not only as the national average, but also in a disaggregated fashion to certain geographical areas, social groups, or age groups. Many routine data sources provide information only at the national level ; e.g., gross domestic product or per capita consumption of protein or energy (" calories "), which derive from national estimates entailing foreign trade, are not readily disaggregated. In most countries life expectancy is computed only for the total population. Similarly, data from a national sample survey might provide reliable indicators for the country as a whole, but not for specified subgroups or geographical areas.

130. This double demand for data sources which are capable of distinguishing apparent from real change over time and also of providing estimates of sufficient reliability for specified subgroups of the national population both limits the number of sources relevant for particular indicators and may also affect the feasibility of using certain sampling schemes for other indicators. Some countries will no doubt have great difficulty in assuring that data sources available to them or capable of being developed with available resources will meet the needs for monitoring changes or supplying disaggregated data, and some compromises will have to be made between the desired precision and the feasibility of attaining that precision.

Principal sources of health indicator data

131. As mentioned in the overview in paragraphs 14–29, the principal data sources for the various proposed indicators can be classified as follows ;

(*a*) vital events registers ;

(*b*) population and housing censuses ;

(*c*) routine health service records ;

(*d*) epidemiological surveillance data ;

(*e*) sample surveys ;

(*f*) disease registers ; and

(*g*) other sources of data (including data from sectors other than health).

132. Table 1 gives an outline of the potential sources of data for indicators of health status, and indicators of provision of health care. A " P " in a column of a particular data source refers to the *primary source* of data where such exists. A " P " in more than a single column means that more than a single source of data is necessary to compute the indicator. When, as is often the case, the primary data source either does not exist or provides unsatisfactory coverage for the purpose of monitoring indicators, *alternative sources* are designated by the letter " A " in the column. The majority of countries will have to use the data sources mentioned in the columns marked by an " A ". The sources to be used will, apart from their availability, be determined by the frequency with which the relevant information is required.

133. The words " primary " and " alternative " refer not only to the accuracy with which a certain indicator might be estimated for monitoring purposes but also to the ultimate desirability of that data source from the information development standpoint more generally. An example of this principle is the vital events register as the preferred data source (along with population census data) for those indicators based on births and deaths. In the large majority of countries properly functioning vital events registers do not exist and it is necessary to resort to demographic surveys, etc., as an alternative source. The demographic survey, however, can never lead to the desired goal of a complete recording of all vital events in a country, with the capability of providing disaggregated data for small population groupings. Thus, where a vital events registration system is not functioning, the demographic survey should be regarded as a temporary substitute rather than a replacement. A general dilemma in providing recommendations on data sources for indicators is that the sources of data that are immediately available to most countries are not necessarily those which could be recommended as long-term solutions to a country's health information problems. Each country should periodically review the sources of data utilized to determine at what point in time a " primary " data source might replace an " alternative " source in providing basic health information.

Vital events registers

134. The United Nations defines a vital events registration system as including " legal registration, statistical recording and reporting of the occurrence of, and the collection, compilation, presentation, analysis and distribution of statistics pertaining to 'vital events', i.e., live births, deaths, foetal deaths, marriages, divorces, adoptions, legitimations, recognitions, annulments and legal separations " (*10*). Ideally such a system should provide comprehensive coverage of a total country and there should be satisfactory reporting of events to the register by the population. If this is the case, then in conjunction with a previously conducted general population census, the vital events registration system is the preferred means by which the various demographic indicators involving data on births, deaths, and age-specific population may be calculated.

135. Unfortunately, adequately functioning vital events registration rarely operates, or operates only for selected (and seldom representative) parts of a country. In many countries lack of resources has confined the development of such systems to large cities where the appropriate infrastructure exists for such registers. Even where a registration system ostensibly covers the whole country, people's failure to report births and deaths may make the rates highly unreliable. According to the United Nations, registration of births and deaths is complete or fairly complete (i.e., 90 % or more) in about 50 countries only, comprising less than one-third of the world population.

136. Because of the nonexistence or unsatisfactory functioning of vital events registration systems in many of the developing countries, it is necessary to resort to alternative means. One solution, attempted in India, is

Table 1. Principal sources of data for indicators or groups of indicators

P = primary source ; A = alternative source

Indicators	Source of data						
	vital events registers	population and household censuses	routine health service records	epidemiological surveillance data	sample surveys	disease registers	other
Health status indicators :							
Birth weight	P				A		
Weight and height			P	A	A		
Arm circumference			P	A	A		
Infant mortality	P	P		A			
Child mortality	P	P			A		
Under-5 mortality	P	P			A		
Under-5 proportionate mortality	P				A		
Life expectancy at given age	P	P			A		
Maternal mortality	P	P	P			A	
Crude birth rate	P	P			A		
Disease-specific death rates	P		P	P	A	A	
Proportionate mortality from specific disease	P		P	P	A	A	
Morbidity :							
incidence rate			P	P	A	P	
prevalence rate			P	P	A	P	
Prevalence of long-term disability			P		A		P
Indicators of the provision of health care :							
Physical accessibility		P	P	A	A		
Percentage of population served		P	P	P	A		
Water and sanitation		P			P		P
Immunization coverage			P	P	A		
Population/health personnel ratio		P	P		A		P

to install vital events registers in several randomly selected areas of the country, using local personnel (e.g., schoolteachers) as registrars. As compared with the usual comprehensive vital events register, where the role of the registration staff is mostly passive, this personnel can be more active in registering vital events, using their knowledge of local conditions and making a persistent publicity effort. If more extensive efforts are used in each of the sample areas than would be feasible at the national level, the result could be more accurate estimates of vital events rates for the entire country.

137. Another solution is to extend progressively the already existing vital events registration areas, even if they do not form a representative sample, to other bordering or surrounding areas. While such a scheme may not produce nationally representative data in the short run, it may be the best long-term solution for a country in which several properly functioning registration areas already exist. It allows for a gradual expansion of the infrastructure at the least expense, and minimizes the administrative and publicity problems involved in setting up new and isolated registers.

138. Because of slow progress in the development of a comprehensive vital events registration system, some countries have attempted to employ first-line health workers to record births and deaths occurring in the community, for use in health care management as well as for the assessment of demographic trends. Indeed, one of the important functions of a primary health care worker is to collect and record data on vital events and other health information in his or her community. With the expansion and development of primary health care programmes and increasing coverage, it will be possible to develop more comprehensive reporting of births and deaths. In order to obtain this information the tool of " lay reporting " has been developed for identifying symptoms and conditions associated with deaths (*5*).[1] Applicability of this methodology is discussed in paragraphs 166 and 167.

Population and housing censuses

139. The United Nations definition of a population census is as follows : " the total process of collecting, compiling and publishing demographic, economic and social data pertaining at a specified time or times, to all persons in a country or delimited territory " (*11*). Complete coverage and individual registration are necessities. Likewise, a housing census involves the collection of data on housing based on complete coverage of the dwellings existing in a country. Population censuses are usually carried out once every 10 years, but may be updated periodically between two censuses with a simpler census collecting a reduced number of data items, or with a " sample " census. Housing censuses are often carried out at the same time as population censuses.

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[1] See footnote to para. 25.

140. Population censuses provide the basic data by which most rates may be computed, i.e., the denominator data (such as population by age and sex) needed for most of the demographic indicators and certain socioeconomic indicators, and "catchment area data"[1] for many of the coverage and accessibility indicators. If certain specific questions dealing with past births and deaths are included, vital events rates can also be estimated. Other health-related items, such as permanent disability, are sometimes included in the census questionnaire. Among the data which are frequently included in a housing census, those concerning water supply, toilet facilities and crowding are particularly relevant to the analysis of environmental health conditions. However, in view of the high costs involved the items to be covered in population and housing censuses should be carefully selected and limited to a strict minimum.

141. One of the main drawbacks of a census as a data source for monitoring purposes is its infrequency. Most censuses are conducted only once every 10 years, and the full results are usually not available quickly, owing to the large amount of data to be processed. In many countries, however, tabulations on certain urgently required items are made on the basis of sample processing (e.g., 5 % to 10 % samples). Certain items (e.g., population by age and sex) are estimated during the period between censuses by updating the data from the previous census by means of information on changes that have since taken place (e.g., births, deaths and migration). It should also be noted that there are still a few countries for which no complete census of population or housing has ever been carried out, and some countries where political, logistic or special difficulties (e.g., nomadic movement during census-taking) have made the counts of certain population groups questionable.

Routine health service records

142. Certain indicators require information of a diagnostic nature (e.g., maternal mortality, disease-specific mortality and morbidity), information on certain measurements usually taken by health service personnel (e.g., birth weight, weight, height, and arm circumference of children), or information as to activities carried out by the health sector (e.g., coverage of various kinds, immunization, prevention and control of endemic diseases, and treatment of common diseases). In many cases the only source of the numerator data for such indicators (where rates are involved) is the health service records.

143. Many of the data generated by the record-keeping system of the health services are kept for administrative purposes rather than for monitoring, and only in ideal conditions will they provide adequate coverage. Since records only exist if the health service has carried out the activity, they do not reflect the situation of any population groups not covered by health service activities, and may therefore give rise to biased

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[1] A "catchment area" is a circumscribed geographical area served by a certain health facility.

pictures. Even when health service records can provide appropriate numerator data, they usually cannot provide the required denominator data (i.e., the population at risk or the population to be covered). Often catchment areas for health services are assumed on a geographical basis, but the population living within the circumscribed area may not necessarily be the actual users of the health services.

144. The accessibility of data may vary. For example, the record-keeping systems of large hospitals in the cities are often more accessible than those of rural dispensaries. More effective organization and use of the records of peripheral health services will lead to better information for health monitoring. With the development of primary health care and increasing coverage by community health workers, there is a need to develop simple, effective data collection systems, both for use at the local level and for forwarding up to the next operational or administrative level.

Epidemiological surveillance

145. In many countries where particular diseases are endemic, special control or action programmes have been instituted to cope with these situations. As part of the disease control programme, surveillance systems are often set up to report on the occurrence of cases and on efforts to control the disease (e.g., immunizations performed on certain groups, or coverage of an area by an insecticide spraying programme).

146. Surveillance programmes are usually closely tied to control programmes for specific diseases, and consequently cover only the corresponding target population groups or geographical areas. They are often developed outside the national health information system and may not have the necessary continuity or representativeness to supply useful data over a long period. Some surveillance systems are set up to act mainly as " alert " or " warning " systems in which the detection of cases of particular diseases is more important than an exact count of cases. In this situation there may be no attempt to relate the occurrence of cases to the exact number of population at risk, so that even if exact counts of a condition were made neither incidence nor prevalence would be computed.

147. In spite of these weaknesses and restrictions, epidemiological surveillance data have the following advantages :

(*a*) the persons carrying out the surveillance are usually trained to recognize or diagnose the disease conditions in question and to measure the relevant characteristics of the community ;

(*b*) complete coverage of the population under surveillance is attempted, usually by means of house-to-house visits. Thus coverage of a population by various types of health services can be measured ;

(*c*) if the population groups covered by surveillance are large enough and considered representative, the mechanisms may be used to obtain other information of public health importance, particularly on conditions which are relatively infrequent (e.g., less than 5 %). Such

events estimated on a small sample would be so imprecise as to render the estimate useless for monitoring purposes ; and

(*d*) surveillance is carried out over a period of time, at least throughout the lifetime of the associated control programme, so that, in addition to baseline data, changes can be estimated at intervals close enough to provide data useful for monitoring.

148. The usefulness of epidemiological surveillance systems in providing information on certain indicators would appear to rest on the following conditions :

(*a*) the control or action programme with which the surveillance system is associated should be established either on a nationwide scale or in several representative regions of the country so as to provide unbiased measures of the indicators ;

(*b*) the duration of the control programme should be such as to provide a useful monitoring period for the indicators ; and

(*c*) some measure of the population at risk should also be available, either provided by the surveillance operation itself or from other sources, so that appropriate rates can be calculated for mortality, morbidity, and health care coverage.

Sample surveys

149. A quick glance at this column in Table 1 may give the impression that the survey is the solution that is most often resorted to for finding appropriate data to compute indicators. While, for certain indicators, questions put to the general population (either on a sample or complete coverage basis) appear to be the most useful means of collecting data (e.g., on actual utilization of various types of health services), the usefulness of the survey method rests on its ability to provide data when other data sources are absent, incomplete, inaccessible or otherwise inadequate. The survey method has disadvantages, however, and these are mentioned in paragraph 156, along with its advantages.

150. A scientifically designed community survey provides estimates of population characteristics within preselected limits of sampling error. The sample may consist of persons, households, houses, schools, etc., depending on the aims of the investigation and the resources available for conducting the study. Unless the aim of the survey is to derive information from a special group (e.g., schoolchildren, or a particular occupation group), the household is the most common sampling unit. It is one that allows for the collection of most social, economic, and health information in a convenient way. Many countries have had at least some experience with this method of data collection, since it is often used in situations where no other official sources of data are available.

151. There is no typical form of household survey. It may be highly clustered or widely dispersed. It may be dedicated to a single topic (e.g., a particular disease) or deal with a large number of topics (multipurpose). It may involve a single visit, or repeated visits over a period of time. It may be

conducted under the auspices of a permanent organization, which ensures continuity of the survey, or may be run by an organization that is dissolved after the survey has been carried out. It is evident that these various aspects will influence the usefulness of household surveys as data sources for health indicators.

152. The size of the sample necessary for a household survey depends upon the measurements being taken and the degree of precision desired. Many national samples typically cover between 5000 and 10 000 households. This is usually considered adequate for providing national estimates on such variables as health care status, anthropometric measurements, food consumption, income, expenditure, housing (including availability of water, sewage disposal and electricity), literacy and school attendance, employment, and household structure and size ; at the same time it allows for some disaggregation for the more frequently occurring characteristics. Such a sample size may also allow for the measurement of changes over a period of time if repeated at reasonable intervals. Where the events being measured occur infrequently in the population, the sample sizes would need to be larger to establish baseline levels and produce estimates of change over time. This is particularly so when vital events rates are to be estimated, such as births (where only 50 per 1000 population is a high rate), and deaths (where 25 per 1000 is high).

153. For the estimation of vital events rates by means of a household survey, certain questions are asked retrospectively—as to births, deaths, and other vital events that have taken place in the past. Alternatively, in order to avoid serious problems of recall, a series of follow-up surveys may be used, in which the *same* households are visited at relatively short, regular intervals (e.g., every 6 months) in order to ascertain the status of each person originally enumerated. In this way, births, deaths and migration are recorded, allowing for the computation of demographic rates. Such a follow-up study is obviously costly and requires special organization of manpower.

154. The auspices under which the survey is to be carried out are of some importance, owing to the need to ensure continuity of information over the monitoring period. A household survey designed to obtain health information only might need the use of specially trained interviewers and more complex questionnaires to obtain information on diseases, disability, and perhaps even on certain vital events. It is doubtful, however, that such a survey could be repeated in many countries at regular intervals of two or three years, because of the high cost of initiating the survey, training and periodically retraining the interviewer staff, and maintaining within the health establishment the necessary infrastructure to mount and carry out the surveys, process data, and make available the results. Attention should therefore be focused on the promotion of close collaboration with an established government statistical agency having access to the necessary expertise in carrying out surveys.

155. The United Nations has recently developed a programme, endorsed by the Economic and Social Council, for the strengthening of national household survey capabilities. By this is meant the organization of surveys on a permanent basis, as already exists in a few countries. Typically, a national central statistical office is charged with the management and execution of all official surveys, demand for which may originate in any government department. Central management is intended to economize both on scarce manpower and expertise, using them to their best ability, and financially, through the sharing of overheads. Government departments, such as the health department, would make use of the organization to conduct their own surveys, or to have questions on health inserted in ongoing multipurpose surveys. Failing this overall multisectoral organization, it might still be worth while for the health authority to set up a more modest but permanent organization of its own to conduct its surveys. Whenever household surveys are used, care has to be taken to correlate results with similar data obtained from other sources (e.g., the health services).

156. All household surveys have a series of advantages and disadvantages. The main advantages are :

(*a*) health information can be related to other household information simultaneously collected, leading to interpretations which would not be possible if the same information was collected from other sources ;

(*b*) information which lies outside the scope of official health services can be collected by direct questioning of the population (e.g., utilization of health care resources from the private sector) ;

(*c*) data on morbidity and disability conditions not requiring health care but restricting activity can be derived only from this source ;

(*d*) morbidity and disability conditions not receiving health care and reasons for nonutilization of health services can be investigated in this way ; these are particularly important for identifying socioeconomic and cultural accessibility of services ;

(*e*) estimates of coverage by various services can be checked by querying actual usage ; and

(*f*) the scientific sampling method can provide estimates of denominator data (e.g., population by age and sex) for the computation of rates and ratios.

Some of the disadvantages are :

(*a*) surveys based on probability sampling are difficult and expensive to mount and execute properly in the absence of an experienced national structure ;

(*b*) information on past diseases and other events reported by the respondent is subject to memory lapse and deliberate omission ;

(*c*) conditions that rarely occur or measures that show large variation in the population require very large sample sizes for precise estimation ;

(*d*) to provide adequate data on indicators for small areas or population groups requires virtually complete coverage rather than sampling ; and

(*e*) surveys are usually one-time activities and seldom lead to a permanent routine data collection procedure.

Disease registers

157. In order to estimate prevalence and incidence of certain diseases thought important to a country and to study their outcome, disease registers may be set up, usually on a population basis, whereby all cases of the selected diseases are reported to a central register. If the reporting system is efficient and the coverage is on a national or representative basis, the register can provide useful data on morbidity from the particular diseases, treatment given, and disease-specific mortality and case fatality.

158. There are several problems involved with disease registers :

(*a*) they require close cooperation of all sectors of the health services if they are not to suffer from omissions due to underreporting ;

(*b*) there may be difficult diagnostic problems resulting in incorrect classification, both geographically and over time ; and

(*c*) coverage is usually a problem, owing to people being treated outside registration areas, and hence not registered, or persons residing outside the covered area being entered in the register because of their treatment in the area.

Alternative data sources and collection methods for health status indicators

159. In the majority of developing countries " primary " data sources, particularly for health status indicators, either do not exist or do not generate reliable data. Alternative data sources as shown in Table 1 (page 44) by the code letter " A " should therefore be explored. Some of the practical problems involved in the collection and analysis of data from such sources are reviewed below.

Nutritional indicators

160. Nutritional indicators are obtained most conveniently through primary health care personnel and, in a community covered by primary health care, data collection does not pose any insurmountable difficulty, provided that standard instruments are made available and the personnel is properly trained in their use. For instance, as low birth weight is one of the most readily recognizable risk factors for the survival of a baby, it is highly desirable that birth weight should be measured for every newborn child by the personnel attending the birth ; the percentage of low birth weight will then be obtained through data aggregation. The validity of this indicator is enhanced as the rate of attendance of trained personnel at births is improved.

161. Anthropometric measurements such as height and weight can be taken on young children when they are receiving care at the local health care centre or at an *ad hoc* examination centre set up by an epidemiological surveillance team. In order not to overburden the surveillance team.

anthropometric measurements may be undertaken only in a representative sample of localities, and at suitably chosen intervals (e.g., every 3 years). The use of home-based weight-for-age charts can greatly simplify the collection of nutritional status data through either a primary health care contact point or health institutions.

Indicators based on births and deaths

162. The generation of these indicators is more difficult than that of nutritional indicators, owing to the fact that data on events occurring over a period of time are required, rather than data relating to a particular point of time. Usually health care personnel routinely record births to ensure the scheduling of adequate care of infants. On the other hand, death records are often incomplete, since dying people are often unattended by health personnel.

163. If national capability exists for undertaking demographic surveys on the probability sampling basis, such surveys can be a useful source of data for indicators. As mentioned in paragraph 153, a simple method is to interview households and ask questions on past reproductive history and deaths. A more elaborate method will be to visit the same households repeatedly at certain intervals and record births and deaths which have occurred during the interval. Great care will have to be taken to avoid omissions of recording.

164. Special methods of analysis have been developed for calculating broad estimates of demographic indicators when none of the above procedures works satisfactorily. These methods are described in paragraphs 168-173.

165. For the computation of many of the demographic indicators, the population size is needed as denominator data. Detailed data, such as breakdowns according to age and sex, have to be obtained by a population census or an *ad hoc* survey, and it may be difficult to bring the detailed statistics up to date. Nevertheless, the primary health care service must have fairly accurate knowledge of the total population of the area in charge and the sizes of certain target groups such as infants, children of 1–4 years of age, and women of reproductive age. These key numbers have to be counted and brought up to date regularly by house-to-house visits.

Disease-specific indicators based on lay reporting

166. In many rural areas there are no physicians available and therefore data on the nature of diseases and the causes of death are generally not available. A new approach has been developed in several countries for the collection and reporting of such data by nonmedical personnel. This approach is known as "lay reporting of health information" (*5*).[1] Naturally, nonmedical personnel are not expected to produce medical diagnoses, but they can be appropriately trained to collect data on the manifestations of diseases, such as symptoms and signs, as expressed in the ordinary language of the community.

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[1] See footnote to para. 25.

167. Analysis and careful scrutiny of these data, using certain guidelines, can provide a meaningful picture of the health situation of the community. Such a system of morbidity and mortality reporting by lay personnel should constitute an important element of information support to primary health care.

Estimation of demographic indicators based on incomplete data

168. When direct measurements of birth and death rates are not available, these rates may be estimated on the basis of indirect evidence. Such methods depend on various assumptions whose validity in actual circumstances it is usually difficult to confirm. Consequently, the margin of error associated with the resulting indicators is unknown. Indirect methods thus provide broad estimates of demographic indicators which are inappropriate for the purpose of regular monitoring, although they may be used for detecting fairly large changes which might occur during a long period of time, say 10 years. Demographic indicators estimated by the United Nations for the majority of the countries in the world have been derived by applying such indirect methods. A few of these methods are briefly described here (*12*).

169. If the age structure of the population is known, either through a population census or a community survey, then a rough idea of mortality rates may be obtained by comparing the number of people belonging to the successive age groups. For example, the difference between the number of children in age groups 5–9 years and 10–15 years may be interpreted as roughly showing how many children of the 5–9 cohort have died over a period of 5 years. In reality, the population figure does not usually remain stationary but increases with time, and hence account should be taken of the possible increase in births year after year. The usual assumption made is that of the stable population—namely, the age-specific patterns of fertility and mortality are assumed to have remained the same over a long period of time, resulting in a constant population growth rate; birth rates and age-specific death rates are estimated by means of theoretical mathematical relationships.

170. The actual computational procedure is usually more complex, taking into account migration and including different kinds of adjustment and smoothing. The latter is applied especially when other useful data are also available, such as the number of children born in the previous year, the average number of children ever born to each woman according to mothers' ages, children still living, etc., which will help in computing estimates with improved precision. Once age-specific death rates are fixed, life expectancy can be calculated on the basis of these rates.

171. One of the further procedures which are frequently applied is to compare the estimated age-specific mortality rates with those of life tables established for other countries having more reliable vital statistics or with a series of the so-called model life tables covering a wide range of situations which are likely to occur in practice, and to choose one which closely resembles the estimated mortality pattern and use it instead. This eliminates

erratic deviations in the estimated mortality pattern which might have been caused by some unknown inadequacies in the data.

172. The estimation procedure will obviously be improved if periodic population censuses or surveys are carried out. By comparing corresponding age cohorts counted at two successive censuses, mortality rates are assessed. For instance, when two successive censuses are taken at a 10-year interval, those who were in the age group 5–9 years at the previous census have passed into the age group 15–19 years by the time of the new census. If the effect of migration is accounted for, the difference between the two figures should show the number of deaths which occurred during the 10-year interval. As countries which have taken at least two population censuses will also have a number of surveys and other data sources upon which to draw, the demographic rates estimated by this method are usually subjected to various kinds of " correction ", smoothing and adjustment.

173. Finally, a serious bias may occur in indicators estimated by indirect means owing to the fact that estimates are not current. As described above, these methods refer to the cumulated experience of the population over the past several years. Data on all children born relate to the reproductive history of women and may not show the true picture of current fertility. Thus the derived indicators represent at best an average over a certain period of time in the past.

Methods of data collection and analysis appropriate for some selected indicators

Health policy indicators

174. Information for health policy indicators can be arrived at from an analysis of statements by a government, a ministry of health, or political and community leaders, as well as from statements in the mass media. Of particular importance is the analysis of national budgets, both to compare the allocation of resources to health with the allocation to other sectors and to analyse the distribution of resources within the health sector. Table 2 illustrates the kind of information required for arriving at indicators of financial resource allocation through the analysis of health and health-related expenditures.

175. Even more detailed breakdowns than those mentioned in Table 2 are in principle possible. Thus, manpower development might be distinguished as a separate category of health service expenditure ; local government expenditure might be distinguished from that of the private sector. Each item, or any combination of items, could be expressed as a percentage of some national economic aggregate such as gross national product, and could serve as an indicator of some aspect of progress towards health for all. However, for many developing countries such a breakdown is hardly feasible in view of its complexity and cost.

Table 2. Health and health-related expenditure

Functional category	Agency and type of expenditure				Total expenditure	
	Government		Private			
	consumption	capital	consumption	capital	consumption	capital
Health sources Primary health care Other Total						
Other social services Education Other Total						
Other health-related activities Water supply Agricultural extension Food etc. Total						

176. In most developing countries the available information will be more restricted. The most favourable general case will be one where the indicators are based on the following distinctions :

— capital versus consumption (recurrent) expenditure ;

— government versus private expenditure ;

— primary health care versus other health service expenditure ; and

— health service versus social and other health-related expenditure.

177. The least favourable case for such an analysis will be one where information is available only on central government expenditure. Such an indicator will give an incomplete reflection of overall health development. On the other hand, it will at least convey information on the activities which form the " cutting edge " of government policy towards health

development. Further, since government expenditure can often be given a geographical location, it can form the basis of another indicator based on the expenditure per head of population in different geographical units (*13, 14, 15*).

Social and economic indicators

178. Information for social and economic indicators is usually obtained from sources other than the health sector. Methods of collection of such information are therefore not described as such.

179. Information on the size and rate of natural increase of the population, its age and sex, and rates of mortality and fertility, is important, both directly and as an input to many health indicators. But it is equally important to many other sectors, and in many countries is the responsibility of a non-health agency such as a department of statistics or the central registration service. It is important to explore the extent to which this information can be obtained from such agencies before using health service resources to obtain it. Creating parallel series—for example, by estimating infant deaths on the basis of reports from health workers independently of the central registration system—may involve problems of consistency at the national and international level. On the other hand, it must be borne in mind that problems of coordination often arise when a central statistical agency attempts to serve many clients from different sectors; it cannot always strike the balance between timeliness, completeness and precision which would suit any particular user. Further, there are often problems of coordination involved in crossing different sectors. However, it will usually be best to leave to a central agency activities which involve complex analysis and processing, such as the preparation of tables of life expectancy at birth and of population projections.

180. Information for calculating the per capita *gross national product* or *gross domestic product*, as well as for assessing personal income and *income distribution,* is usually obtained from ministries of planning or finance. A further source of national accounting information is the national statistical bureau or central bank, though in a few cases the only current estimates may be those prepared by an external agency. A useful standard source for economic and social indicators, covering a number of the items discussed in this document, is the "country data sheet" prepared by the World Bank. However, reference should always be made to the appropriate national statistical agency, if available, for further interpretation.

181. Information on a series of other social indicators, such as work availability, level of employment or underemployment, percentage of women in the labour force, and inability to work due to disability, is often obtained from ministries of labour. Information for educational indicators, such as adult literacy rates or primary and secondary school enrolment, is usually obtained from ministries of education; an assessment of access of people to information, from ministries of information and the like; the state of housing, from ministries of housing or from decennial censuses and, possibly, household surveys and *ad hoc* investigations.

182. It can be seen that in the social and economic fields the indicators which are easily available tend to provide broad aggregate information about the influences on the health of the population but are unsatisfactory as guides to the detailed pattern of changes at the level of individual households or rural communities and their connexion with health changes. Household sample surveys are a possible development which may lead to better local health-related indicators. Another such possibility is the institution of frequent or continuous survey work in a representative set of "observation areas" or "sentinel areas", of the kind under development by the United Nations Research Institute for Social Development. Standard indicators based on such work cannot yet be prescribed, but the field is one with much potential for illuminating the social and economic aspects of health for all.

Indicators of the provision of health care

183. The easiest and cheapest way to collect much of the information required for indicators of the provision of health care is through health service statistics. Health service statistics, however, do not provide information about the need for health care, nor do they provide information on nonusers of the health services and reasons for nonutilization. However, the problem of the incompleteness of information on coverage can be overcome with properly designed, not too complex recording processes and adequate supervision, especially if voluntary health workers as well as traditional birth attendants are also integrated into the system. Information about those who use the services, by comparison with the total population, can provide by inference some information about those who do not use them. Therefore, inexpensive collection of information—for example, through an ongoing programme or service—is in fact a cost-effective method for obtaining information on coverage. With increasing development of primary health care such methods become more useful and more accurate.

Coverage

184. Ideally, accessibility and coverage data, because they relate to a defined geographical area, are most easily collected at the level of subnational administrative units, such as a district or province. The district or provincial data can then be aggregated to provide national data.

185. In general, measurement of accessibility and coverage is dependent on the existence of census data, and on a knowledge of the age and sex distribution of the population and of its geographical distribution. In the absence of any census data it would not be possible to calculate coverage with any accuracy. However, as part of the development of primary health care programmes, some form of census could be undertaken—for example, using community health workers, as part of their training.

186. The following sequence is proposed for collecting information on coverage for a specifically defined geographical area, using examples, assuming that census data are available.

Physical accessibility

187. Physical accessibility is essential before any kind of care can be provided. It is assumed that the national strategy has defined accessibility targets for specific services which provide the minimum eight elements of primary health care. If it has not, the collection of this information can be conducive to doing so. This indicator needs to be established for specific types of health facilities (e.g., primary health care, first-line referral hospital). Health facility is also to be understood as either an established health service (hospital, health centre, dispensary) or a community health worker regularly at the disposal of the population.

188. The information can be collected by a one-day census on a sample of patients attending a sample of health facilities for particular services. From this, information on characteristics of users, their geographical origin, travel time, mode of transport, etc. can be gained. The differential utilization rate (number of visits per person per year) of patients coming from different distances, which can be obtained from examination of record cards and compared with the population of different areas, also provides useful data from which to determine appropriate accessibility targets. For example, in one country it was found that the utilization rate for patients living within six kilometres of a health facility was 186 per 1000 population, dropping to 43 per 1000 at distances over 15 kilometres.

189. In order to monitor accessibility a number of questions can be asked, for example :

(*a*) Are primary health care services (related to priority health problems, e.g., treatment of malaria, oral rehydration for diarrhoea), including essential drugs, available within the community at all times ?

(*b*) Is first-level referral ambulatory care available within one hour's travel time (or within six kilometres) ?

(*c*) Is maternal and child health care (defining what elements are to be included, e.g., antenatal care, nutritional surveillance, immunization) available weekly or monthly ; within the community or within half an hour's walking distance ; and is delivery care available at all times in the community ?

(*d*) Are referral facilities within two hours' reach ? (This relates to the facilities as such : roads, transport, and cost of transport.)[1]

(*e*) Are facilities available for monitoring health hazards at the workplace and for the health surveillance of workers exposed to hazards causing occupational diseases ?

190. Safe drinking-water supply yielding water free from pathogenic organisms and toxic substances includes adequately treated surface water or untreated but noncontaminated water such as that from protected boreholes,

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[1] This information is obtained from interviews with staff and patients. Cost of transport as a proportion of monthly income per head is a factor to be considered in estimating accessibility of referral facilities.

springs and sanitary wells. Access may be defined as the existence of a water tap or other clean water source on the premises of the house, or the availability of a safe water supply within a given distance or walking time from the home, e.g., 15 minutes. A proper definition should be adopted by taking the local conditions into account.

191. The number of houses connected with piped water supply is usually obtainable from a register kept by the public water supply service. The number of people served can be estimated by multiplying the number of houses by the average number of inhabitants per house. This procedure applies particularly in urban areas. For others, a house survey or a housing census should be used to obtain the necessary data.

192. An appropriate national or local definition should also be adopted on access to safe waste disposal, but maximum allowable distances would be considerably shorter than for water. Waste disposal includes the collection and disposal, with or without treatment, of human excreta and waste water by waterborne systems, or the use of pit privies and similar installations. Accessibility of food is more complex and will be determined by socioeconomic indicators relating to income distribution, land availability, etc. Similarly, information on access to adequate housing and information relevant to health will be obtained from socioeconomic indicators.

193. The next sequential step is to determine the proportion of the population with access so defined. This is obtained by mapping population distribution in relation to locations at which health care is available. In the absence of population distribution maps an estimate can be made by identifying the location of service delivery points, defining the services provided at these points and making a crude estimation of the number of people within the defined catchment areas. For specific services such as maternal and child health, an estimate has to be made for the subgroup of population, e.g., women in the childbearing age group or children under 5.

194. Physical accessibility indicators for a district or province would be expressed as the proportion of the total district population with access to specific services or facilities. For example, some of these would be : (*a*) the proportion of the district population within 10 minutes' walk of a protected clean water supply; (*b*) the proportion of women in the childbearing age-group with accessible weekly antenatal care and family planning services in the community ; (*c*) the proportion of under-5s with child care services (malaria prophylaxis, oral rehydration, nutritional surveillance, etc.) accessible at all times within the community (or within half an hour's travelling time).

195. Not everyone who has physical access to services and is in need of services actually uses them. In many cases there are cultural and economic barriers. Before identifying cultural and economic accessibility indicators, it is necessary to estimate the proportion of the accessible population in need of the services who actually use them.

Population served (percentage)

196. This is obtained from health service statistics properly designed to record *individuals,* over a time period such as a year, who used particular services. It is inadequate merely to record new and subsequent visits without relating these to the individual concerned. Using the same categories of services as for accessibility, the number of individuals who contact this service can be recorded relatively simply (e.g., if each patient is recorded in a register for the first time in the year), but subsequent visits are merely recorded on a record card or horizontally in the register, beside the first visit entry. For each service the number of individuals recorded in the year provides the numerator population for assessing coverage.

197. The denominator population is more difficult to obtain, as it relates to those who are in need of particular services. For general ambulatory care, this raises a number of problems such as perception of illness and of the need for care, which is country- and culture-specific ; not all people are in need of medical care every year. The most accurate assessment of coverage for illness care is obtained from community surveys which collect information on the episodes of illness occurring in the community, and whether or not care was sought. However, if community surveys are not feasible, the average number of episodes of illness for which people seek care in a given community can be estimated (often from special utilization studies which have been carried out based on health service data). For example, it has been estimated that in some developing countries with a given age and sex structure and morbidity pattern, where services are physically accessible and there are no major economic or cultural barriers to utilization, the average number of episodes of illness requiring medical care per year is between three and four. Coverage for general first-level health system care could then be defined as an average rate in relation to this normative utilization rate.

198. Another method of assessing coverage of health care for children in particular, which can be used if there is a system of vital statistics registration, is to record for all deaths of children under 5 years whether or not medical care was provided during the final illness.

199. For maternal and child health care, the denominator population is more easily defined, but again depends on census data and the age and sex structure, as well as on a knowledge of the birth rate. If this information is available the number of expected births in a given area and consequently the number of expected pregnancies and needs for antenatal and delivery care can be deduced, allowing for local variation. For example, the coverage for maternal care would be calculated as follows :

(*a*) the percentage of women receiving antenatal care is equal to

$$\frac{\text{Number of first antenatal contacts}}{\text{Number of expected births}} \times 100$$

(*b*) the percentage of women receiving delivery care is equal to

$$\frac{\text{Number of supervised deliveries}}{\text{Number of expected births}} \times 100$$

200. However, coverage also incorporates an implied minimum level or standard of care and one antenatal contact may not constitute adequate coverage. Thus, for more meaningful coverage assessment, the number of antenatal contacts per pregnancy would have to be taken into consideration, as well as the timing of the first contact during the pregnancy, based on predefined norms.

201. For family planning, the number of acceptors in relation to women in the childbearing age-group can be used.

202. For child care the denominator population will be all children under 5 years if census data are available to calculate this for specific geographical areas. Even where it is not known in detail, an estimate can be made if some information on the total population is available, as well as the average age distribution for the country (e.g., 20 % are under 5 years). The number of children receiving nutritional surveillance or other child care services can be obtained from health service records.

203. The number of children who receive particular immunizations or, preferably, are fully immunized, can be obtained from health service records which systematically record vaccinations performed. However, a problem of counting can arise when repeated vaccinations are required for the same individual. Too often simply the number of vaccine doses given out is counted, rather than the number of individuals who have completed the course of immunization. If a systematic recording is not feasible, estimates should be made by surveys of the population. Serological surveys are often advocated to measure antibodies in the relevant population, but they are expensive, time-consuming, and require the necessary laboratory facilities.

204. Coverage can also be estimated for those with chronic communicable diseases, such as tuberculosis and leprosy, if the prevalence has been estimated on the basis of epidemiological surveys. The number of patients in the area under surveillance can be expressed as a proportion of the number of estimated cases in the area.

205. The following examples are given of coverage indicators for a district or other defined geographical area :

(*a*) Percentage of population utilizing services over a one-year period ;

(*b*) Percentage of pregnant women receiving antenatal care :
  (i) at least once per pregnancy ;
  (ii) minimum of *x* contacts by trained person per pregnancy ;

(*c*) Percentage of births supervised by trained person ;

(*d*) Percentage of under-5s :
  (i) fully immunized ;
  (ii) receiving specific immunizations ;

(iii) receiving regular nutritional surveillance (specifying minimum number of contacts per year) ;

(*e*) Percentage of expected tuberculosis (leprosy or other prevalent communicable disease) cases actually diagnosed per year ;

(*f*) Percentage of diagnosed tuberculosis (or leprosy) cases continuing regular treatment (or percentage of defaulters).

Socioeconomic accessibility

206. Finally, having obtained information on the proportion of the population who are covered, information is required about those for whom the services are physically accessible but who do not use the services although they have need of them. As mentioned above, some information on socioeconomic or cultural barriers to utilization can be obtained by comparing characteristics of the user population with those in the community at large, but community surveys are probably the only really appropriate method for obtaining this information. Simple community surveys can be carried out inexpensively by schoolchildren during holidays as part of a health education programme. Also community members can be used to conduct such surveys as part of a primary health care programme—community diagnosis carried out by the community itself.

Population/health personnel ratio

— *Definition*

207. The ratio is computed by :

$$\frac{\text{Population}}{\text{Number of health personnel of the specified type}}$$

which gives the average number of people served by a health worker.

208. Conversely, the following formula is often used :

$$\frac{\text{Number of health personnel of the specified type}}{\text{Population}} \times 10\,000$$

209. The ratio should be computed separately for each type of personnel, e.g., primary health care workers (which may be further subdivided according to the types relevant to the community concerned), physicians, dentists, nurses and pharmacists.

— *Range*

210. The magnitude of the ratio depends on the type of personnel. For example, the population/physician ratio varies from less than 1000 to 1 in affluent countries to more than 50 000 in some of the least developed countries ; for dentists it ranges from 1000 to more than 1 million ; for nursing personnel, from about 100 to more than 10 000 ; and for pharmacists, from 1000 to more than 500 000. These differences observed among countries are, however, partly due to the varying national definitions used for each type of personnel and the degree of completeness of registration.

211. In most countries the ratio shows considerable geographical variations, particularly between urban and rural areas. For example, in some developing countries the population/physician ratio is 10 times larger, or even more, in rural areas than in towns.

— *Data collection*

212. The numbers of health personnel of different types are usually reported to the government. It may, however, be necessary to make a special inquiry regarding certain types of personnel, such as traditional health workers and other voluntary workers not incorporated in the country's health services.

— *Uses*

213. This indicator is used for health manpower planning, regarding both education and training, and geographical redistribution. It is therefore necessary to examine the variation among geographical units.

214. In addition to the population ratio, it will be necessary to study the ratio between various types of personnel, such as the doctor/nurse ratio and the ratio between primary health care personnel and others. These ratios will help in the allocation of resources to strengthen particular types of health workers.

Low birth weight (percentage)

— *Definition*

215. A low birth weight (LBW) is defined as less than 2500 g, the measurement being taken preferably within the first hours of life, before significant postnatal weight loss has occurred (*16*, p. 763). The percentage of LBW is computed by

$$\frac{\text{Liveborn babies with birth weight less than 2500 g}}{\text{Total number of liveborn babies}} \times 100$$

— *Range*

216. In some of the least developed countries the percentage of LBW reaches almost 50 %, while in some developed countries it is as low as 4 %. For the world as a whole, the average for 1979 has been estimated at around 17 %.

— *Data collection*

217. When a birth takes place in an institution (e.g., hospital, maternity home) the birth weight should be measured as a routine, and the percentage of LBW can be computed. When a majority of births take place outside health institutions, the percentage of LBW based on deliveries at institutions may be considerably biased, with no certainty of the direction and magnitude of the bias.

218. Primary health care workers should be instructed to measure birth weight as a routine, by means of a standard balance. If necessary, such an arrangement may be introduced in steps so that the coverage of the population will be increased gradually. In some countries the birth weight is recorded in the birth certificate and reported through the civil registration system. The percentage of LBW can then be computed as a component of routine vital statistics. In communities where a satisfactory civil registration system does not exist, babies dying soon after birth are frequently omitted from any recording. Because of poorer survival of babies with LBW, such babies will tend to be omitted more frequently than those with a higher birth weight, thus leading to an underestimate of the percentage of LBW. When a unit of weight other than the metric system is used in the community, the definition of LBW should be converted into terms of the local unit. It is recommended that, depending on the total population, the percentage of LBW be based on measurements on at least 500 newborn children.

— *Analysis and uses*

219. LBW is the most significant indicator of the risk to the survival of a baby and its healthy growth and development, and is thus an important guide to the level of care needed by individual babies. LBW also reflects inadequate nutrition and ill health of the mother. A high percentage of LBW therefore points to deficient health status of pregnant women, too close a spacing of births, inadequate prenatal care, and the need for improved care of the newborn. In some countries it may be an expression of the degree of malaria endemicity.

220. It will be useful to analyse LBW in relation to age and parity of the mother and, if possible, gestational age of the baby.

221. It seems likely that genetic traits of certain ethnic groups tend to reduce the birth weight without correspondingly reducing the survival chances of the newborn. In such populations, LBW as defined above will have a different meaning.

Low weight for age ; low height for age ; low weight for height (percentages)

— *Definition*

222. Low weight and low height are defined as less than the value corresponding to 2 standard deviations below the median of the respective frequency distributions for healthy children.

223. A national (or international) reference population is used for the calculation of indicators on the weight for age, height for age, and weight for height. A WHO working group (*17*) has recommended that the best available data in this regard are those established by the United States National Center for Health Statistics (*18*). They may be used for children up to 5 years of age, since the influence of ethnic or genetic factors on young children is considered insignificant. The detailed data have been tabularized

for use, in particular, in the measurement of nutritional impact (*8*). Reference data are given in Annexes 1, 2 and 3.

224. The percentages are computed by :

$$\text{Percentage of low weight for age} = \frac{\text{Number of children with low weight for age}}{\text{Total number of children}} \times 100$$

$$\text{Percentage of low height for age} = \frac{\text{Number of children with low height for age}}{\text{Total number of children}} \times 100$$

$$\text{Percentage of low weight for height} = \frac{\text{Number of children with low weight for height}}{\text{Total number of children}} \times 100$$

— *Range*

225. In severely undernourished communities the percentages of low weight for age and low height for age may be much higher than 50 %, while the percentage of low weight for height among children may exceed 20 %. In well-nourished communities the percentages are much less than 5 %.

— *Data collection*

226. Ideally, a permanent health record should be established for each child by the primary health care personnel, including periodic measurements of height and weight, and kept either by the primary health care service or by the mother. Children with low weight for age, low height for age, and low weight for height can be identified by scrutinizing such child health records at appropriate intervals of time, and the required percentages computed. For " height ", supine length is measured in children under 2 years of age, and stature (standing height) in older children. The use of standard instruments by primary health care personnel should be promoted.

227. The reference data on the three measurements are reproduced in Annexes 1, 2 and 3. Besides the threshold value—namely, median minus 2 standard deviations (SD)—the median is also shown in the tables.

228. When a permanent health record is not maintained for each child, weight, height and age of children may be recorded in conjunction with a visit to provide immunization services or to obtain other survey information, by an epidemiological survey team, or in a household survey.

229. In most countries age can be recorded fairly accurately for young children, but in some countries the assessment of age cannot be made accurately for older children. With careful questioning of the family and relating the birth to a local calendar of events, such as the agricultural cycle, the death of a chief, or a visit to a nearby town by a head of state, a fairly accurate estimate of age can often be obtained, and would allow the

establishment of an indicator for weight for age and height for age. The percentage of low weight for height, however, can be computed in any case, even when age cannot be assessed accurately.

230. Each indicator should preferably be based on measurements on at least 500 children.

—Analysis and uses

231. The percentage of low height for age reflects the cumulative effects of undernutrition and infections since birth or even before birth. A high percentage therefore should be interpreted as an indication of bad environmental conditions and/or early malnutrition. The percentage of low weight for height, on the other hand, reflects exclusively current undernutrition or disease. The percentage of low weight for age reflects both the cumulative effects of episodes of undernutrition or chronic undernutrition since birth and current undernutrition. It is thus a composite indicator and more difficult to interpret than the other two.

Small upper-arm circumference (percentage)

— Definition

232. A small circumference may be defined as less than the value corresponding to the 5th percentile of the frequency distribution for well-nourished children. A national (or international) reference population is used for the calculation of this indicator. The best available data in this regard are those established by the United States National Center for Health Statistics. The relevant threshold value and median at different ages are reproduced in Annex 4.

— Range

233. In a poorly-nourished population the percentage may exceed 50 %. In a well-nourished population it does not exceed 5 %.

— Data collection

234. The circumference is measured at the middle of the left upper arm. The child's arm should be hanging relaxed and just away from his or her side. When taking the measurement, a metal or plastic tape is held horizontally in light contact with the skin. The measurement of arm circumference is less precise than that of height and weight. Nevertheless, it leads to a useful indicator if measured on a representative sample of at least 500 children. The sample should preferably be made up of the same age composition as the child population in the community.

— Uses

235. The upper-arm circumference reflects the nutritional status of children. If the percentage of small arm circumference is high, action is called for to improve child nutrition. The arm circumference has been used also in screening children for relief measures in emergencies.

— *Definition*

Infant mortality rate

236. The infant mortality rate (IMR) is computed per 1000 liveborn, namely,

$$\frac{\text{Number of deaths under 1 year of age during a period of time}}{\text{Number of live-births during the same period}} \times 1000$$

— *Range*

237. In least developed countries the rate has been estimated to be as high as 200 per 1000, while in affluent countries it is less than 15 per 1000. The world average for 1978 has been estimated at about 90 per 1000.

— *Data collection and calculation*

238. In countries where there is a satisfactorily functioning civil registration system (coverage more than 90 %), the IMR may be computed from the registered figures. When there is no satisfactory civil registration system, primary health care personnel may be made responsible for reporting births and infant deaths. If this does not produce any reliable data, several methods exist which assume either the existence of one or more censuses or the presence of one or more demographic surveys. With censuses it is necessary to add several simple questions, for all women over the age of 15 years, on the fertility experience and subsequent deaths of children. For example, death occurring before a child walks can be an approximate indicator of infant mortality. From questions of this nature indirect estimates of deaths at the 2nd, 3rd and 4th anniversaries after birth can be obtained. Before reasonable estimation of the IMR is made, however, graduation (or smoothing) must be carried out by means of a model life table representing the mortality experience of the region to which the country belongs. Several variants of these indirect methods exist, using adjustment formulae of varying degrees of complexity, based on varying assumptions as to changes in fertility and mortality patterns in mothers of various ages.

239. Demographic surveys carried out by either single or repeat visits provide direct estimates of vital events—e.g., the number of births during a certain recall period, and the number of subsequent deaths. A single survey obtains the necessary information retrospectively and is subject to problems of recall and omission. Follow-up surveys on the same households within short intervals (e.g., 6 months) appear to provide more accurate estimates of infant mortality, but may be too expensive for monitoring purposes.

240. Because infant deaths are relatively rare events, a large number of households need to be followed. Table 3 gives some idea of sample sizes (in terms of the number of people that need to be visited, assuming there are no errors in the reporting of births and deaths) in order to achieve various 95 % confidence interval widths for the IMR. It is assumed, for purposes of

illustration, that the birth rate is 40 per 1000 population, and that the observed IMR is 100 per 1000 liveborn. It is evident that estimates of reasonable accuracy depend upon sample sizes of at least 50 000 persons. If this degree of accuracy is applicable for a country as a whole, disaggregated results (e.g., for regions of the country) will have much wider confidence intervals.

Table 3. Infant mortality rate : sample size and confidence interval

Sample size : number of persons	Number of births observed	Number of infant deaths observed	95 % confidence interval for the infant mortality rate
1 000	40	4	4 - 196
5 000	200	20	58 - 142
10 000	400	40	70 - 130
50 000	2 000	200	87 - 113
100 000	4 000	400	91 - 109
250 000	10 000	1 000	94 - 106
500 000	20 000	2 000	96 - 104

Source : TABUTIN, D., Mortalité des enfants dans les pays en développement. In : *La mortalité des enfants dans le tiers-monde.* Chaire Quetelet 1979, Département de Démographie, Université catholique de Louvain, Ordina Editions, Liège, 1979, pp. 13-73.

241. The IMR not only reflects the magnitude of those health problems which are directly responsible for the death of infants, such as diarrhoeal and respiratory infections and malnutrition, along with other specific infectious diseases and perinatal conditions, but it also reflects the level of health of mothers, the level of antenatal and postnatal care of mother and infant, family planning policy, the environmental health situation and, in general, the socioeconomic development of a society. Within a society it has also been found in both developed and developing countries that the IMR shows an inverse correlation with socioeconomic status of the parent, no matter what criterion of determining socioeconomic status is used. The IMR has also been found to be very indicative of changes over time in health conditions in a country. In countries where data on the IMR have been calculated for long periods steady reductions have been noted parallel with improvements in standards of living and sanitary conditions and increased availability and accessibility of health services to the population.

Child mortality rate

— *Definition*

242. The rate is computed by :

$$\frac{\text{Number of deaths of children aged 1–4 years during a year}}{\text{Total number of children aged 1–4 years at the middle of the year}} \times 1000$$

— *Range*

243. In least developed countries the rate may be as high as 100 per 1000, while in highly developed countries the rate is around 0.4 per 1000.

— *Data collection*

244. The possible sources of the numerator data on deaths are vital events registration, primary health care records, and community surveys. The denominator data on population are taken from census tabulations or estimations made between censuses. As young children are a target group for immunization, their population size should preferably be recorded by the local primary health care unit or by the immunization team. It is desirable that the child mortality rate should be based on a population of at least 5000 children in the age group 1–4 years.

— *Uses*

245. As the child mortality rate reflects the adverse environmental health hazards (e.g., malnutrition, poor hygiene, infections and accidents), investigation should be made in those communities in which the rate is high, so as to identify the most important adverse factors in the community and take necessary action to reduce them.

Under-5 mortality rate

— *Definition*

246. The rate is calculated by :

$$\frac{\text{Number of deaths under 5 years of age in the given year}}{\text{Total number of children under 5 years of age at the middle of the year}} \times 1000$$

— *Range*

247. In countries with very poor health conditions the rate exceeds 100. In highly developed countries it is as low as 2.

— *Data collection*

248. Procedures similar to those for the child mortality rate apply. The rate should preferably be based on a child population of at least 5000. (See paragraph 244.)

— *Uses*

249. A high under-5 mortality rate reflects unhealthy perinatal conditions to which mothers are subjected and the effects of adverse environmental factors in early childhood.

Under-5 proportionate mortality

— *Definition*

250. The proportion is calculated by :

$$\frac{\text{Number of deaths under 5 years of age during a given period}}{\text{Total number of deaths during the same period}} \times 100$$

— *Range*

251. In communities with poor hygiene the proportion may exceed 60 %. At the other end of the scale, the proportion is less than 2 % in some of the European countries.

— *Data collection*

252. The same procedures as for the under-5 mortality rate apply. This indicator, being a ratio, does not require population data. The proportion should be based on observations on not less than 200 deaths. When the total number of deaths occurring in the community is not known, it can be calculated from partial data such as hospital statistics or incomplete civil death registration. Account has to be taken of the biases inherent in such partial data.

Life expectancy

— *Definition*

253. Life expectancy—or expectation of life—at a given age is the average number of years which a person at that age is expected to live under the mortality pattern prevalent in the community or country. Life expectancy at birth is used most frequently.

— *Range*

254. The life expectancy at birth ranges from less than 40 years in some of the least developed countries to over 70 years in developed countries. The world average is estimated at 61 years.

— *Data collection*

255. Life expectancy is calculated on the basis of age-specific death rates, namely,

$$\frac{\text{Number of deaths in a given age group in a given year}}{\text{Population in the given age group at middle of the year}} \times 1000$$

for each age group. Ideally, the age grouping should be as fine as possible, e.g., days during the first week of life, weeks up to the fourth week, months up to the twelfth month, and thereafter single years up to the 99th year of age. However, for the purpose of health monitoring, broader age groups are usually adequate, such as under 1 year, 1–4 years, thereafter 5–year age groups up to 84 years, and finally 85 years and over as one group. For

countries with low life-expectancy at birth (e.g., below 60 years), the highest age group could be 70 years (with 70 years and over as the final group).

256. Life expectancy is often computed separately for each sex. For this purpose, age- and sex-specific death rates are required which are based upon statistics on the population and on deaths, with appropriate breakdowns according to age and sex. In order to determine a reasonably precise life expectancy, it is recommended that the calculation be applied to a population of at least 1 million. For a smaller population data over a few calendar years may be combined to compute the average life expectancy over that period of time.

257. When accurate age-specific death rates are not available, model life tables may be used in order to obtain a broad estimate of life expectancy. A series of model life tables has been constructed to represent a wide range of mortality patterns which occur among countries at different levels of socioeconomic development. On the basis of the available evidence, which is often very scanty, one of the model life tables is chosen which is considered to best fit the conditions of the country in question. While the estimate thus produced may reflect broadly the level of life expectancy and may also be used for the assessment of long-term trends (e.g., over 10 years), it will not be precise enough for continuous monitoring. For the latter purpose, the availability of fairly accurate age-specific death rates is therefore essential.

— *Computation procedure*

258. Life expectancy is a composite indicator based upon age-specific death rates. It is calculated as one of the quantities included in the life table. Briefly, the computation of a life table follows the following sequence (see Table 4 for an example):

(*a*) On the basis of each age-specific death rate, M_i (column 4), the probability of dying in the age group, $\hat{q}_i$ (column 6), is computed. The formula used is:

$$\hat{q}_i = \frac{n_i M_i}{1+(1-a_i)n_i M_i}$$

where n_i is the number of years covered in the interval (i.e., 1 for the first age group, 4 for the second age group and 5 for each of the subsequent age groups), and a_i as shown in column 5 is a constant. However, a value of a_0, that is, a_i for the first age group, should be chosen, according to the infant mortality rate, as follows:

Infant mortality (per 1000 live births)	a_0 value
less than 20	0.09
between 20 and 40	0.15
between 40 and 60	0.23
more than 60	0.30

the other a_i values need not be changed; the values given in column 5 should be used. For the last age group (85 years and over in this example), $\hat{q}_i$ is not computed by means of the above formula but is fixed at 1.

(*b*) Starting from a convenient base population (l_0) (e.g., 100 000 in column 7), the probability of dying in the first age group (i.e., under 1 year) is multiplied by $\hat{q}_i$ (column 6) to obtain the number of deaths (d_i) in that age group (column 8).

(*c*) By substracting the number of deaths (column 8) from the base number (column 7), the number of survivors (l_i) is calculated (enter on the next line under column 7).

Table 4. Specimen

Age interval number	Age interval (in years)	Mid-year population in interval (x_i, x_{i+1})	Number of deaths in interval (x_i, x_{i+1})	Death rate	Fraction of last age interval of life
i	x_i to x_{i+1}	P_i	D_i	M_i	a_i
(0)	(1)	(2)	(3)	(4)	(5)
0	0-1	340 483	6 234	0.018309	0.09
1	1-5	1 302 198	1 049	0.000806	0.41
2	5-10	1 918 117	723	0.000377	0.44
3	10-15	1 963 681	735	0.000374	0.54
4	15-20	1 817 379	2 054	0.001130	0.59
5	20-25	1 740 966	2 702	0.001552	0.49
6	25-30	1 457 614	2 071	0.001421	0.51
7	30-35	1 219 389	1 964	0.001611	0.52
8	35-40	1 149 999	2 588	0.002250	0.53
9	40-45	1 208 550	4 114	0.003404	0.54
10	45-50	1 245 903	6 722	0.005395	0.53
11	50-55	1 083 852	8 948	0.008256	0.53
12	55-60	933 244	11 942	0.012796	0.52
13	60-65	770 770	14 309	0.018565	0.52
14	65-70	620 805	17 088	0.027526	0.51
15	70-75	484 431	19 149	0.039529	0.52
16	75-80	342 097	21 325	0.062336	0.51
17	80-85	210 953	20 129	0.095419	0.50
18	85+	142 691	22 483	0.157564	

[1]Source : CHIN LONG CHIANG. *Life table and mortality analysis.* Geneva, World Health Organization,1978, pp.96-97.
[2]The computation of this type of table is described in para. 258.

(*d*) On the basis of (*b*) the total number of years lived by the base population through the first age group, L_i (column 9), is also computed. The formula used is :

$$L_i = n_i\,(l_i - d_i) + a_i n_i d_i$$

(*e*) Processes (*b*), (*c*) and (*d*) are repeated for the survivors by applying the probability of death for the next age group. This is repeated until all the age groups are dealt with.

(*f*) By adding up L_i (column 9), the total number of years lived computed for all age groups, we obtain the total lifetime, T_0 (column 10). By dividing this sum by the base population (l_0) the life expectancy at birth is obtained (71.95 years in this example).

(*g*) For life expectancy at a given age, the total number of years lived should be summed up, starting with that given age. This sum should then be divided by the number of survivors at that age to obtain the required life expectancy. In order to facilitate this computation, column 10 shows the cumulative total computed starting from the last age group upwards.

abridged life table[1,2]

Probability of dying in interval (x_i, x_{i+1})	Number living at age x_i	Number of deaths in interval (x_i, x_{i+1})	Number of years lived in interval (x_i, x_{i+1})	Total number of years lived beyond age x_i	Observed expectation of life at age x_i
$\hat{q}_i$	l_i	d_i	L_i	T_i	e_i
(6)	(7)	(8)	(9)	(10)	(11)
0.01801	100 000	1 801	98 361	7 195 221	71.95
0.00322	98 199	316	392 050	7 096 860	72.27
0.00188	97 883	184	488 900	6 704 810	68.50
0.00187	97 699	183	488 074	6 215 910	63.62
0.00564	97 516	550	486 452	5 727 836	58.74
0.00773	96 966	750	482 917	5 241 384	54.05
0.00708	96 216	681	479 412	4 758 467	49.46
0.00802	95 535	766	475 837	4 279 055	44.79
0.01119	94 769	1 060	471 354	3 803 218	40.13
0.01689	93 709	1 583	464 904	3 331 864	35.56
0.02664	92 126	2 454	454 863	2 866 960	31.12
0.04049	89 672	3 631	439 827	2 412 097	26.90
0.06207	86 041	5 341	417 387	1 972 270	22.92
0.08886	80 700	7 171	386 290	1 554 883	19.27
0.12893	73 529	9 480	344 419	1 168 593	15.89
0.18052	64 049	11 562	292 496	824 174	12.87
0.27039	52 487	14 192	227 665	531 678	10.13
0.38521	38 295	14 752	154 595	304 013	7.94
1.00000	23 543	23 543	149 418	149 418	6.35

— *Uses*

259. Life expectancy is considered as a general indicator of the level of living. From the point of view of health, however, action may be taken to reduce age-specific mortality in order to improve life expectancy. For example, if a community or a country has low life expectancy compared with other communities or countries, the age-specific mortality rates should be examined and the age groups showing high death rates identified. In particular, the level of infant mortality exerts a significant influence on life expectancy. If the health reasons for the high mortality are detected, this will lead to appropriate action.

Maternal mortality rate

— *Definition*

260. A maternal death is defined as the death of a woman while pregnant or within 42 days of end of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. The maternal mortality rate should be expressed per 1000 live-births (*16,* pp. 764 and 766). In communities where such a long follow-up is not possible, a shorter period (say, 48 hours or 7 days) may be used, provided it is clearly stated.

— *Range*

261. The rates observed in different countries range from 0.1 per 1000 live-births to over 10 per 1000 live-births.

— *Data collection*

262. The computation of the rate implies a well-developed registration system of births and deaths, as well as of causes of death. In the absence of a reliable registration system, a proxy measurement may be used based on a count of deaths among women soon after childbirth. To be used as a health indicator, the rate should preferably be based on observations on at least 50 maternal deaths.

— *Analysis and uses*

263. The maternal mortality rate reflects the risk to mothers during pregnancy and childbirth and is influenced by :

— general socioeconomic conditions ;
— unsatisfactory health conditions preceding the pregnancy ;
— incidence of the various complications of pregnancy and childbirth ;
— availability and utilization of health care facilities, including prenatal and obstetric care.

264. In countries with a small population (e.g., less than half a million) and also in some larger countries with very low maternal mortality the rate

should be considered with great caution, as annual rates are subject to considerable random variation.

265. Maternal mortality rises from the low values at 20–24 years to the highest values at 40 or more years of age. If the number permits, therefore, it is appropriate to compute the age-adjusted maternal mortality rate. Likewise, if feasible, the rate may be disaggregated into two groups according to :

(*a*) direct obstetric deaths, i.e., those resulting from obstetric complication of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above ; and

(*b*) indirect obstetric deaths, i.e., those resulting from previous existing disease, or disease which developed during pregnancy and was not due to direct obstetric causes, but was aggravated by the physiological effects of pregnancy.

266. In addition, in some countries special rates are calculated separately for abortion-related mortality.

Crude birth rate

— *Definition*

267. The rate is calculated by :

$$\frac{\text{Number of live births in a given year}}{\text{Population at middle of the year}} \times 1000$$

— *Range*

268. The crude birth rate ranges from 10 per 1000 population in countries with low fertility to 50 per 1000 population in countries with high fertility. The average for the world is currently estimated at 29 per 1000 population.

— *Data collection*

269. Estimated total population and the number of births obtained through a civil registration system provide the necessary data. In the absence of a reliable registration system, a count of births taken by primary health care personnel may provide the data. For example, traditional birth attendants, if integrated into the primary health care system, can collect these data. If they are illiterate they can be asked to put stones in a bottle for each delivery, which can be counted at the next contact with the health system personnel. Retroactive recording may also be used, such as at a population census by household surveys.

270. For the purpose of monitoring, it is desirable that the crude birth rate should be based upon a population of at least 10 000.

— *Uses*

271. A very high crude birth rate indicates frequent occurrence of births to teenage mothers and at high maternal ages, as well as short birth–spacing.

Disease-specific death rate

— *Definition*

272. The rate is computed by :

$$\frac{\text{Number of deaths from a specific disease during a calendar year}}{\text{Population at middle of the year}} \times 100\,000$$

— *Range*

273. The magnitude and variability of the rate depend obviously on the disease. Mortality from communicable diseases shows a particularly wide variation among countries. For example, the death rate from tuberculosis varies from less than 1 to over 300 per 100 000 population.

— *Data collection*

274. This rate is obtained mainly in countries in which a satisfactory civil registration system operates and in which a high proportion of deaths is certified medically. Nevertheless, lay reporting[1] may be used to establish death rates from certain causes—e.g., gastroenteritis, measles, tetanus, malaria, and accidents. Instructions using local terminology should be issued to guide the primary health care personnel.

275. The establishment of a death rate from an infrequent disease will require observations in a large population. As a general rule, it is recommended that the rate should be based on at least 100 deaths from the specific disease (i.e., the numerator of the rate) in order to keep the effect of random fluctuations at an insignificant level.

— *Analysis and uses*

276. A high death rate will indicate the public health importance of the particular disease. The reliability of the determination of causes of death should be carefully examined.

277. For a disease limited to one sex (e.g., cancer of the cervix) the rate should be computed by using the population of the sex as the denominator. More generally, the death rates are influenced also by the age/sex composition of the population. It is therefore desirable to establish the rates by age and sex, namely,

$$\frac{\text{Number of deaths from the specific disease which occurred to a given age and sex during a calendar year}}{\text{Population of the age/sex group}} \times 100\,000$$

[1] See footnote to para. 25.

Such rates should be used for comparing rates over a long period of time (e.g., 10 years or more), or chronologically among communities with different age and sex structure. The age-specific rate is usually computed separately for each sex.

278. In order to summarize age- and disease-specific death rates, the age-standardized death rate is sometimes computed. For this purpose, a standard age-composition is used and the rate is worked out which would prevail should the actual population have the standard age-composition. In this manner, the effect of different age structures can be removed from the comparison of mortality. A frequently used standard age-composition (*19*) is shown in Table 5 with an example of computation of the age-standardized death rate. Each age-specific death rate (for stomach cancer in this example) in column 3 is multiplied by the standard population for the age group in column 2 to obtain the product in column 4 ; the sum of the products is then divided by 100 000 to give the age-standardized rate (69.7 in this example).

Table 5. Example of computation of age-standardized death rate

Age group	Standard population	Age-specific death rate	Product (2 x 3)
(1)	(2)	(3)	(4)
0	2 400	0.2	480
1 - 4	9 600	0.4	3 840
5 - 9	10 000	0.1	1 000
10 - 14	9 000	0.1	900
15 - 19	9 000	0.2	1 800
20 - 24	8 000	0.3	2 400
25 - 29	8 000	3.3	26 400
30 - 34	6 000	7.5	45 000
35 - 39	6 000	15.1	90 600
40 - 44	6 000	32.0	192 000
45 - 49	6 000	61.7	369 600
50 - 54	5 000	117.1	585 500
55 - 59	4 000	207.2	828 800
60 - 64	4 000	313.5	1 254 000
65 - 69	3 000	455.3	1 365 900
70 - 74	2 000	573.6	1 147 200
75 - 79	1 000	609.5	609 500
80 - 84	500	515.3	257 650
85 +	500	375.4	187 700
Total	100 000		6 970 270

Age-standardized death rate = 6 970 270/100 000 = 69.7

Proportionate mortality from specific diseases

— *Definition*

279. The proportionate mortality from a specific disease is computed by :

$$\frac{\text{Number of deaths from the specific disease}}{\text{Number of deaths from all causes}} \times 100$$

This percentage is computed usually for a broad disease group, such as communicable diseases as a whole, and for a specific disease of major public health importance, such as ischaemic heart disease in industrialized countries.

— *Range*

280. The level and variability of this indicator depend on the disease. For communicable diseases the range varies among countries from less than 1 % to more than 30 %.

— *Data collection*

281. In countries where a reliable death registration scheme exists, statistics tabulated by causes of death should be used. In the absence of such registration, lay reporting[1] may be used to establish broad causes of death. Appropriate instructions using local terminology should guide primary health care personnel. By contrast with the indicator of disease-specific death rates, there is no need to obtain the figure for the population size. It is desirable that the proportionate mortality should be based on a study of a total of at least 500 deaths (i.e., the denominator in the formula).

— *Analysis and uses*

282. The proportionate mortality indicates the relative importance of the specific disease, or disease group, as cause of death. Mortality from communicable diseases is especially important, as it relates mostly to preventable conditions. The reliability of the determination of causes of death should be carefully examined.

283. Since the prevailing causes of death vary according to age and sex, it is desirable to compute proportionate mortality separately for each age and sex group, or at least for each sex group, in order to determine measures directed to particular age and sex groups for the reduction of preventable mortality.

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[1] See footnote to para. 25.

Morbidity—incidence rate

— *Definition*

284. Incidence rate is defined as the number of illnesses (spells or persons, as applicable) beginning within a specified period of time and related to the average number of persons exposed to risk during that period. The rate is expressed per 1000 (or per 10 000, or 100 000) persons per annum.

— *Data collection*

285. Among the various sources of morbidity statistics, the following are of importance :

(*a*) hospital records of inpatients, together with records of attendance of out-patients in hospitals, clinics, dispensaries, school medical services, etc. ;

(*b*) records taken during domiciliary visits by health staff ;

(*c*) special sickness surveys covering the whole community or samples of it ; and

(*d*) absenteeism and sickness records in educational institutions, civil services, and private enterprises.

The methods of collecting data differ according to the disease(s) considered, the diagnostic means and the degree of accuracy required.

— *Uses*

286. The incidence rate as a health status indicator is useful for taking action to control diseases and for research into etiology and pathogenesis, distribution of diseases, and efficacy of preventive and therapeutic measures. Analysis of differences in incidence rates reported from various socioeconomic groups and geographical areas may also provide useful insights into the effectiveness of the health services provided.

Morbidity—prevalence rate

— *Definition*

287. Prevalence rate may refer to point prevalence or period prevalence. The point prevalence rate is computed by relating the number of sick persons existing at a specific point of time to the number of persons exposed to risk. The period prevalence rate relates to the number of illnesses existing at any time within a specified period. The rates are expressed as a percentage or per 1000, 10 000, etc.

— *Data collection and use*

288. The observations under " Morbidity—incidence rate " apply ; see paragraphs 285 and 286.

Long-term disability—prevalence

— *Definition*

289. A disability is defined as any restriction or lack of ability to perform an activity in the manner or within the range considered normal for a human being (*20*). Disability may take the form of disturbances in behaving in an appropriate manner, in personal care (such as excretory control and the ability to wash and feed oneself), in the performance of other activities of daily living, and in locomotive activities (such as the ability to walk). There is no international definition of what duration should be considered long-term. A practical definition should be established which will suit the particular conditions of the community.

290. The prevalence of long-term disability is expressed by the percentage of population experiencing long-term disability, namely,

$$\frac{\text{Number of persons suffering from long-term disability}}{\text{Total number of persons investigated}} \times 100$$

291. This indicator may be computed separately for any specific disability which is of public health importance in the community, e.g., blindness.

— *Range*

292. The magnitude of the prevalence depends on the types of disabilities considered. With all long-term disabilities taken together, the prevalence is about 10 %, or even more in many countries, including the industrialized countries.

— *Data collection*

293. The method most frequently used is a community survey in which households are visited and persons suffering from long-term disability are recorded. The status of long-term disability is often included as an item in a population census. As a large number of enumerators are employed in a population census, simple and practical instructions should be provided to them on how to identify long-term disability.

294. In some countries a significant proportion of the disabled population lives in institutions. In such cases, a general household survey cannot give a measure of the prevalence of disability. At least 1000 persons should be included in the sample representative of the population. A larger sample will be needed to estimate the prevalence of specific disability ; for example, for establishing prevalence of visual disability the sample should preferably cover at least 5000 people. Likewise the sample size should be increased for estimation of prevalence according to age groups, etc.

— *Uses*

295. The indicator is used for investigating the causes of disability and for planning for preventive, curative and rehabilitative measures.

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Annex 1

Weight (kg) for Age : Reference Values[1]

A. Ages 0 - 24 months

Age (months)	Boys		Girls	
	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
0	2.5	3.3	2.2	3.2
1	2.9	4.3	2.8	4.0
2	3.5	5.2	3.3	4.7
3	4.1	6.0	3.9	5.4
4	4.7	6.7	4.5	6.0
5	5.3	7.3	5.0	6.7
6	5.9	7.8	5.5	7.2
7	6.4	8.3	5.9	7.7
8	6.9	8.8	6.3	8.2
9	7.2	9.2	6.6	8.6
10	7.6	9.5	6.9	8.9
11	7.9	9.9	7.2	9.2
12	8.1	10.2	7.4	9.5
13	8.3	10.4	7.6	9.8
14	8.5	10.7	7.8	10.0
15	8.7	10.9	8.0	10.2
16	8.8	11.1	8.2	10.4
17	9.0	11.3	8.3	10.6
18	9.1	11.5	8.5	10.8
19	9.2	11.7	8.6	11.0
20	9.4	11.8	8.8	11.2
21	9.5	12.0	9.0	11.4
22	9.7	12.2	9.1	11.5
23	9.8	12.4	9.3	11.7
24	9.9	12.6	9.4	11.9

[1]See para. 223.

Weight (kg) for Age : Reference Values *(continued)*

B. Ages 2-5 years

Age		Boys		Girls	
(years)	(months)	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
2	1	10.2	12.5	9.6	12.0
2	2	10.3	12.7	9.8	12.2
2	3	10.4	12.9	9.9	12.4
2	4	10.5	13.1	10.1	12.6
2	5	10.6	13.3	10.2	12.8
2	6	10.7	13.5	10.3	13.0
2	7	10.9	13.7	10.5	13.2
2	8	11.0	13.9	10.6	13.4
2	9	11.1	14.1	10.8	13.6
2	10	11.2	14.3	10.9	13.8
2	11	11.3	14.4	11.0	13.9
3	0	11.4	14.6	11.2	14.1
3	1	11.5	14.8	11.3	14.3
3	2	11.7	15.0	11.4	14.4
3	3	11.8	15.2	11.5	14.6
3	4	11.9	15.3	11.6	14.8
3	5	12.0	15.5	11.8	14.9
3	6	12.1	15.7	11.9	15.1
3	7	12.3	15.8	12.0	15.2
3	8	12.4	16.0	12.1	15.4
3	9	12.5	16.2	12.2	15.5
3	10	12.6	16.4	12.3	15.7
3	11	12.8	16.5	12.4	15.8
4	0	12.9	16.7	12.6	16.0
4	1	13.0	16.9	12.7	16.1
4	2	13.1	17.0	12.8	16.2
4	3	13.3	17.2	12.9	16.4
4	4	13.4	17.4	13.0	16.5
4	5	13.5	17.5	13.1	16.7
4	6	13.7	17.7	13.2	16.8
4	7	13.8	17.9	13.3	17.0
4	8	13.9	18.0	13.4	17.1
4	9	14.0	18.2	13.5	17.2
4	10	14.2	18.3	13.6	17.4
4	11	14.3	18.5	13.7	17.5
5	0	14.4	18.7	13.8	17.7

Annex 2

Height (cm) for Age : Reference Values[1]

A. Ages 0 - 24 months — Supine length

Supine length				
Age (months)	Boys		Girls	
	median —2SD (cm)	median (cm)	median —2SD (cm)	median (cm)
0	45.9	50.5	45.5	49.9
1	49.7	54.6	49.0	53.5
2	52.9	58.1	52.0	56.8
3	55.8	61.1	54.6	59.5
4	58.3	63.7	56.9	62.0
5	60.5	65.9	58.9	64.1
6	62.4	67.8	60.6	65.9
7	64.1	69.5	62.2	67.6
8	65.7	71.0	63.7	69.1
9	67.0	72.3	65.0	70.4
10	68.3	73.6	66.2	71.8
11	69.6	74.9	67.5	73.1
12	70.7	76.1	68.6	74.3
13	71.8	77.2	69.8	75.5
14	72.8	78.3	70.8	76.7
15	73.7	79.4	71.9	77.8
16	74.6	80.4	72.9	78.9
17	75.5	81.4	73.8	79.9
18	76.3	82.4	74.8	80.9
19	77.1	83.3	75.7	81.9
20	77.9	84.2	76.6	82.9
21	78.7	85.1	77.4	83.8
22	79.4	86.0	78.3	84.7
23	80.2	86.8	79.1	85.6
24	80.9	87.6	79.9	86.5

[1]See para. 223.

Height (cm) for Age : Reference Values *(continued)*

B. Ages 2-5 years —Stature

Stature					
Age		Boys		Girls	
(years)	(months)	median —2SD (cm)	median (cm)	median —2SD (cm)	median (cm)
2	1	79.9	86.4	78.8	85.3
2	2	80.6	87.2	79.6	86.2
2	3	81.3	88.1	80.3	87.0
2	4	82.0	88.9	81.0	87.9
2	5	82.7	89.6	81.8	88.7
2	6	83.4	90.4	82.5	89.5
2	7	84.1	91.2	83.1	90.3
2	8	84.7	92.0	83.8	91.0
2	9	85.4	92.7	84.5	91.8
2	10	86.0	93.5	85.2	92.5
2	11	86.7	94.2	85.8	93.2
3	0	87.3	94.9	86.5	94.0
3	1	87.9	95.6	87.1	94.6
3	2	88.6	96.3	87.7	95.3
3	3	89.2	97.0	88.4	96.0
3	4	89.8	97.7	89.0	96.6
3	5	90.4	98.4	89.6	97.3
3	6	91.0	99.1	90.2	97.9
3	7	91.6	99.7	90.7	98.6
3	8	92.1	100.4	91.3	99.2
3	9	92.7	101.0	91.9	99.0
3	10	93.3	101.7	92.4	100.4
3	11	93.9	102.3	93.0	101.0
4	0	94.4	102.9	93.5	101.6
4	1	95.0	103.6	94.1	102.2
4	2	95.5	104.2	94.6	102.7
4	3	96.1	104.8	95.1	103.3
4	4	96.6	105.4	95.6	103.9
4	5	97.1	106.0	96.1	104.5
4	6	97.7	106.6	96.7	105.0
4	7	98.2	107.1	97.1	105.6
4	8	98.7	107.7	97.6	106.2
4	9	99.2	108.3	98.1	106.7
4	10	99.7	108.8	98.6	107.3
4	11	100.2	109.4	99.1	107.8
5	0	100.7	109.9	99.5	108.4

Annex 3

Weight (kg) for Height (cm) : Reference Values[1]

A. Supine length (cm)

Supine length (cm)	Boys		Girls	
	median —SD (kg)	median (kg)	median —2SD (kg)	median (kg)
49.0	2.5	3.2	2.6	3.3
49.5	2.5	3.2	2.6	3.3
50.0	2.5	3.3	2.6	3.4
50.5	2.6	3.4	2.7	3.5
51.0	2.6	3.5	2.7	3.5
51.5	2.7	3.6	2.8	3.6
52.0	2.8	3.7	2.8	3.7
52.5	2.8	3.8	2.9	3.8
53.0	2.9	3.9	3.0	3.9
53.5	3.0	4.0	3.1	4.0
54.0	3.1	4.1	3.1	4.1
54.5	3.2	4.2	3.2	4.2
55.0	3.3	4.3	3.3	4.3
55.5	3.3	4.5	3.4	4.4
56.0	3.4	4.6	3.5	4.5
56.5	3.6	4.7	3.6	4.6
57.0	3.7	4.8	3.7	4.8
57.5	3.8	5.0	3.8	4.9
58.0	3.9	5.1	3.9	5.0
58.5	4.0	5.2	4.0	5.1
59.0	4.1	5.4	4.1	5.3
59.5	4.2	5.5	4.2	5.4
60.0	4.4	5.7	4.3	5.5
60.5	4.5	5.8	4.4	5.7
61.0	4.6	5.9	4.6	5.8
61.5	4.8	6.1	4.7	6.0
62.0	4.9	6.2	4.8	6.1
62.5	5.0	6.4	4.9	6.2
63.0	5.2	6.5	5.0	6.4
63.5	5.3	6.7	5.2	6.5
64.0	5.4	6.8	5.3	6.7
64.5	5.6	7.0	5.4	6.8
65.0	5.7	7.1	5.5	7.0
65.5	5.8	7.3	5.7	7.1
66.0	6.0	7.4	5.8	7.3
66.5	6.1	7.6	5.9	7.4
67.0	6.2	7.7	6.0	7.5
67.5	6.4	7.8	6.2	7.7
68.0	6.5	8.0	6.3	7.8

Supine length (cm)	Boys		Girls	
	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
68.5	6.6	8.1	6.4	8.0
69.0	6.8	8.3	6.5	8.1
69.5	6.9	8.4	6.7	8.2
70.0	7.0	8.5	6.8	8.4
70.5	7.2	8.7	6.9	8.5
71.0	7.3	8.8	7.0	8.6
71.5	7.4	8.9	7.1	8.8
72.0	7.5	9.1	7.2	8.9
72.5	7.7	9.2	7.4	9.0
73.0	7.8	9.3	7.5	9.1
73.5	7.9	9.5	7.6	9.3
74.0	8.0	9.6	7.7	9.4
74.5	8.1	9.7	7.8	9.5
75.0	8.2	9.8	7.9	9.6
75.5	8.3	9.9	8.0	9.7
76.0	8.4	10.0	8.1	9.8
76.5	8.5	10.2	8.2	9.9
77.0	8.6	10.3	8.3	10.0
77.5	8.7	10.4	8.4	10.1
78.0	8.8	10.5	8.5	10.2
78.5	8.9	10.6	8.6	10.3
79.0	9.0	10.7	8.7	10.4
79.5	9.1	10.8	8.7	10.5
80.0	9.2	10.9	8.8	10.6
80.5	9.3	11.0	8.9	10.7
81.0	9.4	11.1	9.0	10.8
81.5	9.5	11.2	9.1	10.9
82.0	9.6	11.3	9.2	11.0
82.5	9.6	11.4	9.3	11.1
83.0	9.7	11.5	9.4	11.2
83.5	9.8	11.6	9.5	11.3
84.0	9.9	11.7	9.6	11.4
84.5	10.0	11.8	9.6	11.5
85.0	10.1	11.9	9.7	11.6
85.5	10.2	12.0	9.8	11.7
86.0	10.3	12.1	9.9	11.8
86.5	10.4	12.2	10.0	11.8
87.0	10.5	12.3	10.1	11.9
87.5	10.5	12.4	10.2	12.0

[1]See para. 223.

Weight (kg) for Height (cm) : Reference Values *(continued)*

A. Supine length (cm) (continued)

Supine length (cm)	Boys		Girls	
	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
88.0	10.6	12.5	10.3	12.2
88.5	10.7	12.7	10.4	12.3
89.0	10.8	12.8	10.5	12.4
89.5	10.9	12.9	10.6	12.5
90.0	11.0	13.0	10.7	12.6
90.5	11.1	13.1	10.8	12.7
91.0	11.2	13.2	10.9	12.8
91.5	11.3	13.3	11.0	12.9
92.0	11.4	13.4	11.1	13.0
92.5	11.5	13.5	11.2	13.1
93.0	11.6	13.7	11.3	13.3
93.5	11.7	13.8	11.4	13.4
94.0	11.9	13.9	11.5	13.5
94.5	12.0	14.0	11.6	13.6
95.0	12.1	14.1	11.8	13.8
95.5	12.2	14.3	11.9	13.9

Supine length (cm)	Boys		Girls	
	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
96.0	12.3	14.4	12.0	14.0
96.5	12.4	14.5	12.1	14.2
97.0	12.5	14.7	12.2	14.3
97.5	12.7	14.8	12.4	14.4
98.0	12.8	14.9	12.5	14.6
98.5	12.9	15.1	12.6	14.7
99.0	13.0	15.2	12.8	14.9
99.5	13.1	15.4	12.9	15.0
100.0	13.3	15.5	13.1	15.2
100.5	13.4	15.7	13.2	15.3
101.0	13.5	15.8	13.3	15.5
101.5	13.6	16.0		
102.0	13.8	16.1		
102.5	13.9	16.3		
103.0	14.0	16.5		

Weight (kg) for Height (cm) : Reference Values *(continued)*

B. Stature (cm)

Stature (cm)	Boys		Girls	
	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
55.0	3.1	4.6	3.2	4.6
55.5	3.2	4.7	3.3	4.7
56.0	3.3	4.8	3.4	4.8
56.5	3.4	5.0	3.4	4.9
57.0	3.5	5.1	3.5	5.1
57.5	3.6	5.2	3.6	5.2
58.0	3.7	5.4	3.7	5.3
58.5	3.8	5.5	3.8	5.5
59.0	3.9	5.6	4.0	5.6
59.5	4.0	5.8	4.1	5.7
60.0	4.2	5.9	4.2	5.9
60.5	4.3	6.1	4.3	6.0
61.0	4.4	6.2	4.4	6.2
61.5	4.5	6.4	4.5	6.3
62.0	4.7	6.5	4.7	6.4
62.5	4.8	6.6	4.8	6.6
63.0	4.9	6.8	4.9	6.7
63.5	5.1	6.9	5.0	6.9
64.0	5.2	7.1	5.1	7.0
64.5	5.3	7.2	5.3	7.2
65.0	5.5	7.4	5.4	7.3
65.5	5.6	7.5	5.5	7.5
66.0	5.7	7.7	5.7	7.6
66.5	5.9	7.8	5.8	7.7
67.0	6.0	8.0	5.9	7.9
67.5	6.2	8.1	6.0	8.0
68.0	6.3	8.2	6.2	8.2
68.5	6.4	8.4	6.3	8.3
69.0	6.6	8.5	6.4	8.4
69.5	6.7	8.7	6.5	8.6
70.0	6.8	8.8	6.7	8.7
70.5	7.0	8.9	6.8	8.8
71.0	7.1	9.1	6.9	8.9
71.5	7.2	9.2	7.0	9.1
72.0	7.3	9.3	7.1	9.2
72.5	7.5	9.4	7.3	9.3
73.0	7.6	9.6	7.4	9.4
73.5	7.7	9.7	7.5	9.5
74.0	7.8	9.8	7.6	9.6
74.5	7.9	9.9	7.7	9.7
75.0	8.0	10.0	7.8	9.8
75.5	8.1	10.1	7.9	10.0
76.0	8.2	10.3	8.0	10.1
76.5	8.4	10.4	8.1	10.2
77.0	8.5	10.5	8.2	10.3
77.5	8.6	10.6	8.3	10.4
78.0	8.7	10.7	8.4	10.5
78.5	8.7	10.8	8.5	10.5
79.0	8.8	10.9	8.6	10.6
79.5	8.9	11.0	8.7	10.7
80.0	9.0	11.1	8.8	10.8
80.5	9.1	11.2	8.8	10.9
81.0	9.2	11.3	8.9	11.0
81.5	9.3	11.4	9.0	11.1
82.0	9.4	11.5	9.1	11.2
82.5	9.5	11.6	9.2	11.3
83.0	9.6	11.7	9.3	11.4
83.5	9.7	11.8	9.4	11.5
84.0	9.8	11.9	9.5	11.6
84.5	9.8	12.0	9.6	11.7
85.0	9.9	12.1	9.6	11.8
85.5	10.0	12.2	9.7	11.9
86.0	10.1	12.3	9.8	12.0
86.5	10.2	12.4	9.9	12.1
87.0	10.3	12.5	10.0	12.2
87.5	10.4	12.6	10.1	12.3
88.0	10.5	12.7	10.2	12.4
88.5	10.6	12.9	10.3	12.5
89.0	10.7	13.0	10.4	12.6
89.5	10.8	13.1	10.5	12.7
90.0	10.9	13.2	10.6	12.8
90.5	10.9	13.3	10.7	13.0
91.0	11.0	13.4	10.8	13.1
91.5	11.1	13.5	10.9	13.2
92.0	11.2	13.6	11.0	13.3
92.5	11.3	13.8	11.1	13.4
93.0	11.5	13.9	11.2	13.6
93.5	11.6	14.0	11.3	13.7
94.0	11.7	14.1	11.4	13.8
94.5	11.8	14.2	11.5	14.0
95.0	11.9	14.4	11.6	14.1
95.5	12.0	14.5	11.7	14.2
96.0	12.1	14.6	11.8	14.4
96.5	12.2	14.8	12.0	14.5

Weight (kg) for Height (cm): Reference Values *(continued)*

B. Stature (cm)

Stature (cm)	Boys		Girls	
	median —2SD (kg)	median (kg)	median —2SD (kg)	median (kg)
97.0	12.3	14.9	12.1	14.6
97.5	12.4	15.0	12.2	14.7
98.0	12.5	15.2	12.3	14.9
98.5	12.6	15.3	12.4	15.0
99.0	12.7	15.4	12.5	15.1
99.5	12.8	15.6	12.6	15.3
100.0	12.9	15.7	12.7	15.4
100.5	13.1	15.8	12.8	15.5
101.0	13.2	16.0	12.9	15.7
101.5	13.3	16.1	13.0	15.8
102.0	13.4	16.3	13.1	15.9
102.5	13.5	16.4	13.2	16.1
103.0	13.6	16.5	13.3	16.2
103.5	13.8	16.7	13.5	16.3
104.0	13.9	16.8	13.6	16.5
104.5	14.0	17.0	13.7	16.6
105.0	14.1	17.1	13.8	16.8
105.5	14.3	17.3	13.9	16.9
106.0	14.4	17.4	14.0	17.0
106.5	14.5	17.6	14.2	17.2
107.0	14.7	17.7	14.3	17.3
107.5	14.8	17.9	14.4	17.5
108.0	14.9	18.1	14.5	17.6
108.5	15.1	18.2	14.7	17.8
109.0	15.2	18.4	14.8	17.9
109.5	15.3	18.5	14.9	18.1
110.0	15.5	18.7	15.0	18.2
110.5	15.6	18.9	15.2	18.4
111.0	15.8	19.0	15.3	18.6
111.5	15.9	19.2	15.4	18.7
112.0	16.1	19.4	15.6	18.9
112.5	16.2	19.5	15.7	19.1
113.0	16.4	19.7	15.9	19.2
113.5	16.5	19.9	16.0	19.4
114.0	16.7	20.0	16.2	19.6
114.5	16.8	20.2	16.3	19.7
115.0	17.0	20.4	16.5	19.9
115.5	17.1	20.6	16.6	20.1
116.0	17.3	20.7	16.8	20.3
116.5	17.4	20.9	16.9	20.5
117.0	17.6	21.1	17.1	20.6
117.5	17.8	21.3	17.2	20.8
118.0	17.9	21.5	17.4	21.0
118.5	18.1	21.7	17.6	21.2
119.0	18.3	21.9	17.7	21.4
119.5	18.4	22.0	17.9	21.6
120.0	18.6	22.2	18.1	21.8
120.5	18.8	22.4	18.2	22.0
121.0	18.9	22.6	18.4	22.2
121.5	19.1	22.8	18.6	22.5
122.0	19.3	23.0	18.8	22.7
122.5	19.5	23.2	18.9	22.9
123.0	19.6	23.5	19.1	23.1
123.5	19.8	23.7	19.3	23.4
124.0	20.0	23.9	19.5	23.6
124.5	20.2	24.1	19.7	23.8
125.0	20.4	24.3	19.9	24.1
125.5	20.6	24.5	20.1	24.3
126.0	20.7	24.8	20.3	24.6
126.5	20.9	25.0	20.4	24.8
127.0	21.1	25.2	20.6	25.1
127.5	21.3	25.5	20.8	25.4
128.0	21.5	25.7	21.0	25.7
128.5	21.7	26.0	21.2	25.9
129.0	21.9	26.2	21.4	26.2
129.5	22.1	26.5	21.6	26.5
130.0	22.3	26.7	21.9	26.8
130.5	22.5	27.0	22.1	27.1
131.0	22.7	27.3	22.3	27.4
131.5	22.9	27.5	22.5	27.7
132.0	23.1	27.8	22.7	28.0
132.5	23.3	28.1	22.9	28.4
133.0	23.5	28.4	23.1	28.7
133.5	23.7	28.7	23.4	29.0
134.0	23.9	29.0	23.6	29.4
134.5	24.1	29.3	23.8	29.7
135.0	24.4	29.6	24.0	30.1
135.5	24.6	29.9	24.3	30.4
136.0	24.8	30.2	24.5	30.8
136.5	25.0	30.5	24.7	31.2
137.0	25.2	30.9	24.9	31.5
137.5	25.4	31.2		
138.0	25.7	31.5		
138.5	25.9	31.9		

Annex 4

Smoothed 5th Percentile and Median of Arm Circumference (cm)[1]

Exact age in years	Boys		Girls	
	5th percentile (cm)	median (cm)	5th percentile (cm)	median (cm)
2.0	14.3	16.0	13.8	15.9
2.5	14.5	16.3	14.0	16.1
3.0	14.7	16.5	14.3	16.2
3.5	14.9	16.7	14.5	16.4
4.0	15.0	16.9	14.7	16.6
4.5	15.1	17.1	14.8	16.8
5.0	15.1	17.2	15.0	17.0
5.5	15.2	17.3	15.1	17.3
6.0	15.3	17.5	15.2	17.5
6.5	15.4	17.7	15.4	17.8
7.0	15.5	17.9	15.5	18.0
7.5	15.7	18.1	15.7	18.4
8.0	15.9	18.4	15.9	18.7
8.5	16.2	18.8	16.1	19.1
9.0	16.5	19.1	16.3	19.4
9.5	16.8	19.6	16.6	19.9
10.0	17.2	20.0	17.0	20.3

Data source : National Center for Health Statistics, USA.

[1]See para. 232.

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